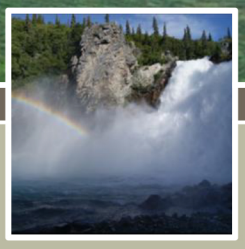

KODIAK

REGIONAL ENERGY PLAN

Volume II: Community Profiles

Prepared for the Alaska Energy Authority

Updated March 2015

SWAMC

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Old Harbor Native Corporation: *Cynthia Berns, Melissa Berns*
Rural Alaska First: *Jenny Evans*
United States Coast Guard Kodiak Base: *Mike Brown*

CONTENTS

INTRODUCTION

The Kodiak Regional Energy Plan is part of a statewide effort led by the Alaska Energy Authority to identify energy projects that will reduce the long-term cost of power and dependence on fossil fuels in Alaska. The process will look at the total mix of energy needs in the Kodiak region, including electricity, heating and transportation, and consider all local and regional energy resources, including efficiency and conservation.

This is a companion volume to the Kodiak Regional Energy Plan: Resource Inventory and Stakeholder Outreach. The Resource Inventory provides a broad overview of energy use and supply in the Kodiak region, outlines regional energy strategies, and includes notes on renewable energy technologies, project economics and data gaps. The Stakeholder Outreach describes the methodology and steps taken in Phase II of the energy planning process to engage with energy stakeholders and collect feedback and regional and community energy priorities.

Phase I with the resource inventory and community profiles was the first step in the planning process. Phase II involved dialog with community and regional leaders, residents, utilities, industry representatives, and other key stakeholders about their priorities for addressing energy needs in the region. The Phase I Resource Inventory and Community Profiles were used as tools during Phase II to focus conversations on the most technically feasible and economically realistic projects given the region's mix of energy resources and the current state of technology.

The data included in these volumes represent a snapshot in time and some will be out of date. Corrections collected during Phase II have been included. A full list of corrections and updates are in Volume I, Appendix C. Though factual inaccuracies have been addressed, data has not been updated to reflect information released since August 2014.

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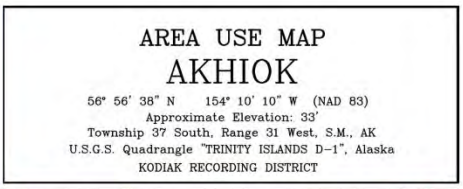
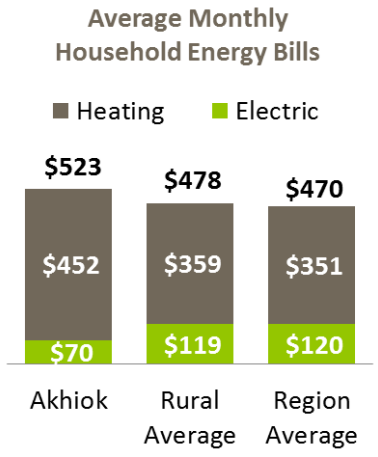
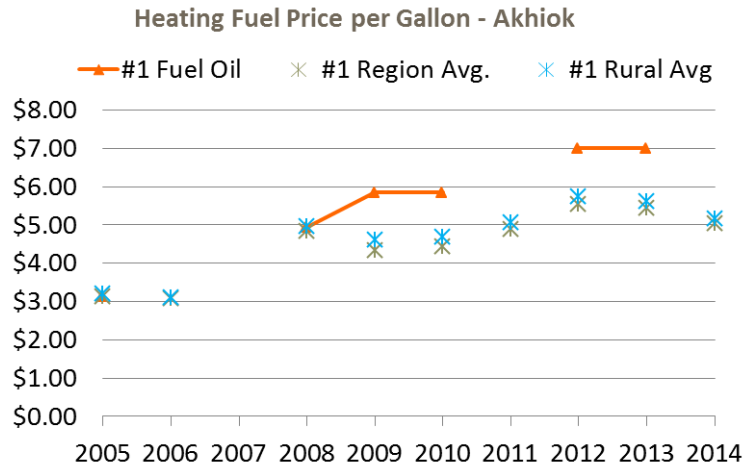


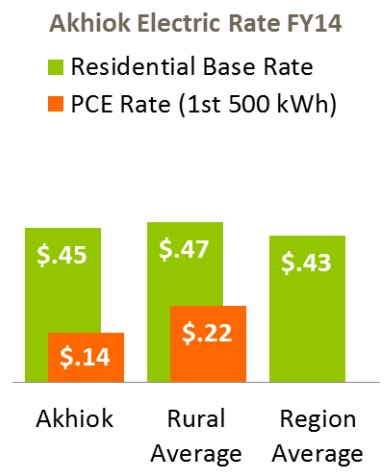
Community Energy Priorities[1]	Priorities	Concerns
	Wind/Hydro investment with overall power system upgrade	- Ageing housing stock - Limited ability to expand fuel capacity - Bulk fuel storage and powerhouse are undersized - Backhaul needed
	Address electricity frequency issues	
	Truck to shuttle fuel from bulk fuel facility to powerhouse	
	Need AMPY Smart meters	
Local Stakeholders Groups	City of Akhiok (utility owner)	Native Village of Akhiok (federally recognized tribe)
	Ocean Beauty Seafoods, Alitak (industry, fuel vendor)	Akhiok-Kaguyak Native Corporation (landowner)
Energy Champions[1]	Dan McCoy (Utility Manager, City Manager), David Eluska (Tribe)	
Sources: **(1) (2) (3)**. **Notes**: Based on Phase II input.		

TOTAL ENERGY USE			
Electrical Generation [1]	**Diesel**: 365 MWh **Renewable**: 0	**Sold**: 342 MWh	**Line Loss**: 4.5% **Powerhouse**: 1.8%
Community Load	Average: 25 kW Peak: 57 kW (4)	**Electric Customers**	**Residential**: 22 **Community Facilities**: 4 **Govt. Facilities**: 1 **Commercial**: 5 **Other (Non-PCE)**: 0
Annual Fuel Use	**Electric**[1]: 35,340 gals.	**Space Heating**: 27,357 gals (4)	**Transportation**: 7,317 gals. (4)
Fuel Price	**Electric**: $3.75/gal.	**Heating**: $7.00/gal of #1 Oil (Jan. 2014) (5)	**Transportation**: NA

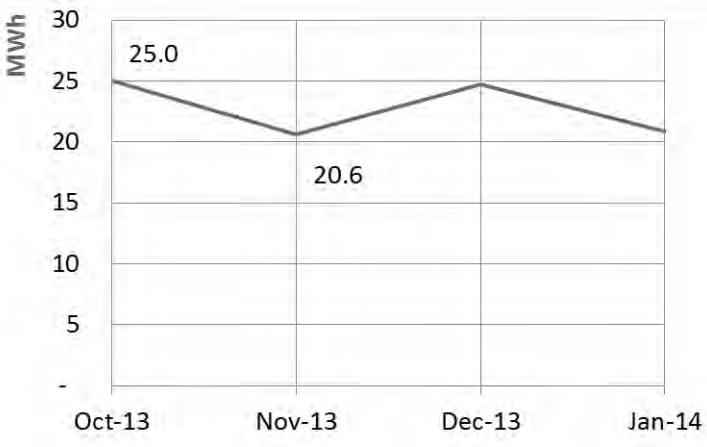


Heating Fuel Cost (5)

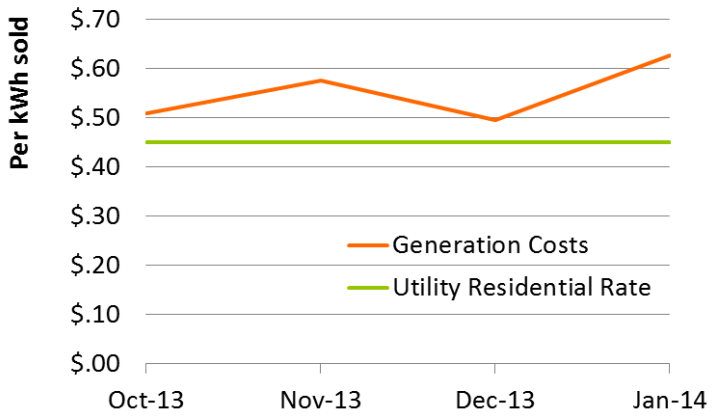
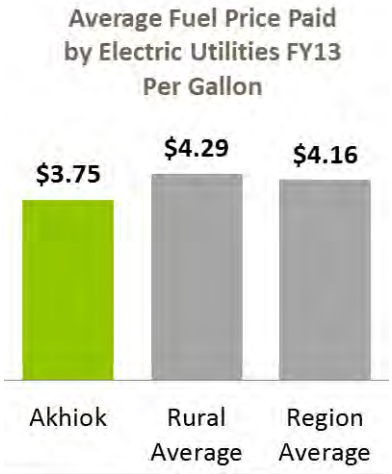
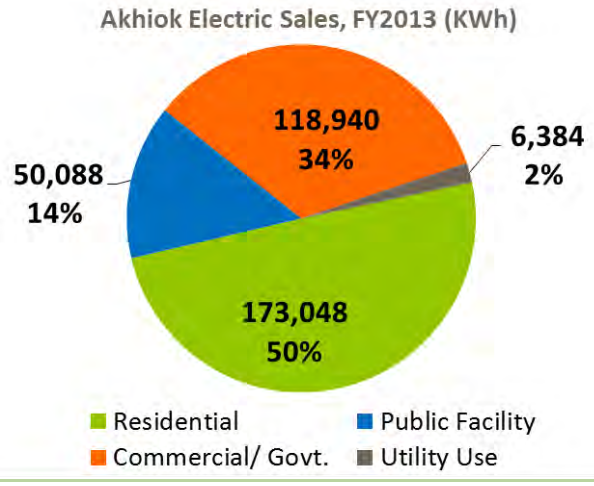
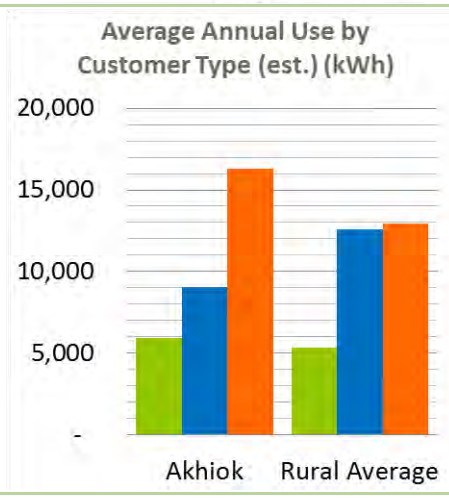




Electrical Generation (5)



Sources (except as noted): **(6)**. **Notes**: 1/ Annual use estimated, based on four months of data (October 2013 to January 2014). Since energy demand is likely to be highest in winter, this may overestimate actual annual electrical generation and sales.

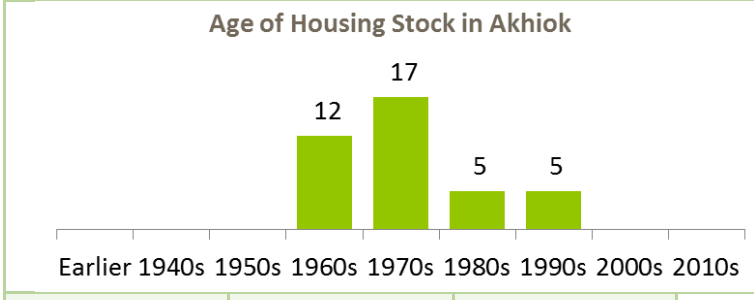
ELECTRIC GENERATION			
Utility	Akhiok/Kaguyak Electric		
PCE (level)	Active since Sept 2013 ($0.31/kWh)	RPSU Upgrade (3)	**Generator**: 2010 **Powerhouse**: None
Diesel Capacity	**G1**: 75 kW / **G2**: 150 kW / **G3**: 135 kW	Renewable Capacity	None
Diesel Generators	**G1**: John Deere 4045 – Fair **G2**: John Deere 4045 – Fair **G3**: John Deere 4045 – Fair	Load Sizing	Properly sized
		Load Imbalance	10-25%
Diesel Efficiency	10.3 kWh/gal.	Switchgear	Semi-automatic synchronizing switchgear
Residential Rate	**Effective**: $0.14/kWh (1st 500 kWh). **Base**: $0.45/kWh	Cost per kWh Sold	**Fuel**: $0.48; **Non-Fuel**: $0.04 **Total cost**: $0.51
Operator Proficiency	**Unacceptable**: Meter reading, logs, maintenance and planning	Heat Recovery	NA: This section of the RPSU survey was not completed.
Known Issues	Distribution system is in poor repair. Powerhouse has poor lighting, ventilation, security and high risk health and safety issues. Fuel shortages are frequent, plant being turned off at night to conserve fuel in the summer months. Outages are from unit G3 EGR and overload of other units.		
Generation Costs			
Electric Sales by Customer Type			

Sources (except as noted): **(7) (8)**

ENERGY EFFICIENCY AND CONSERVATION

Residential

Occupied Housing Units	Housing Type, including Vacant	Average Home Size (est.)[1]	Avg. HH Size / Overcrowded	Median HH Income	Energy Cost as % of Income
19	39 single family	1,056 sf	4.4 / 22.5%	$16,250	39%

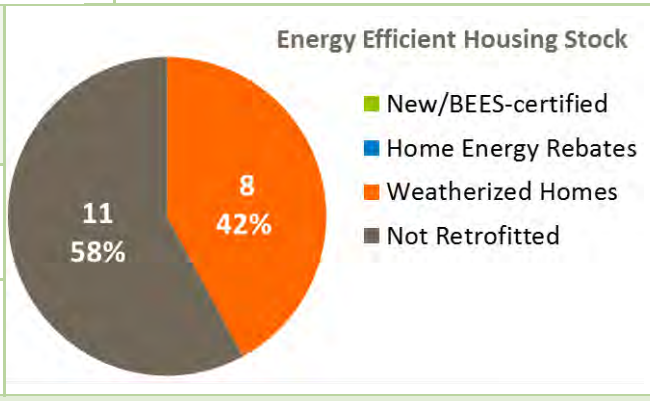


Estimate Annual Energy Use per Home	Average Annual Home Energy Bill
125 MMBTU	$6,272

Note: Older homes are typically less energy-efficient than newer homes, due to improvements in building technology and energy efficiency over time.

Annual Home Energy Savings Achieved	Additional Annual Home Energy Savings Opportunity	Percent of Residential EE&C Work Remaining
184 MMBTU 1,322 gals. $9,255	272 MMBTU 1,955 gals. $13,683	60%

Assumptions: Average energy savings for region based on 2008-13 ARIS data (35% HER, 18% AHFC weatherization projects).



Non-residential

No. of Public/ Commercial Buildings[2]	Types of Buildings	Est. Annual Energy Use per Building[3]	Public or Commercial Building Audits	EE&C Measures Identified	EE&C Measures Implemented
10	See Appendix B	1,178 MMBTU	None Reported	NA	NA
Street Light Number	**Street Lighting Type**	**LED Street Lighting Upgrade**	**Street Lighting Remaining Opportunity**	**Estimated Cost of LED Street Light Retrofit[4]**	**LED Street Lighting Annual Energy Savings**
Not Known	5 LED	Completed 2013	Not Known	$1,000 per light or $5,000 to $18,000 total	Installed LEDS use only $5 of electricity/mo.
Water & Sewer System Type / No. of Homes Served	**Water and Sewer Rates**	**Estimated Annual Water & Sewer Energy Use[1]**	**Sanitation System Energy Audit Performed**	**Estimated Cost of Water & Sewer EE&C Upgrades**	**Estimated Annual Water & Sewer Energy Savings[5]**
Piped 19 Homes	Not Known	195 MMBTU 1,168 gals. 9,585 kWh	No. New modular water treatment plant being installed.	Not Known	20 MMBTU 210 gals. 958 kWh $1,469

Sources: (9) (10) (3). **Notes**: 1/ Calculated based on Energy End-Use Study data (11). 2/ Based on number of electric rate payers. 3/ Calculated based on Energy End-Use Study and 2013 Alaska Housing Assessment data (11) (12). 4/ Based on ARIS data for communities of 50 to 100 people. 5/ Assumes 10% savings on fuel and electric.

DIESEL EFFICIENCY AND HEAT RECOVERY					
Annual Savings from a Diesel Efficiency of 13.0 kWh/gal.[1]	Heat Recovery Installed at Power Plant	Buildings Heated with Waste Heat	Additional Heat Recovery Opportunity	Estimated Cost of Water Jacket Heat Recovery	Est. Annual Savings from Water Jacket Heat Recovery
5,459 gals. $20,484	No (Power Plant is ¾ mi. from town)	0	Powerhouse is ¾ mile from town	Capital cost: $200,000 and up	464 MMBTU[2] or 10 to 20%

BULK FUEL			
Capacity	**City**: 36,000 gals. (6,000 for school district use) **Ocean Beauty Seafoods**: Not Known	Fuel Purchase	26,000 to 30,000 gals. for electric utility per year (as much as community can afford). Fuel conservation in effect in summer to stretch to Sept. fuel delivery.
Bulk Fuel Upgrade	Completed 2003	Vendors	**Electric Utility**: Petro Marine Services (Homer). **Heating**: (Residential and others): Ocean Beauty Seafoods
By Barge	No deep water dock. Akhiok uses a landing craft to bring fuel in. Boat hauls 31,000 gallons of fuel. Tank farm is 2miles from the dock. It is very difficult to get fuel to the tank farm.		
Local Delivery	Ocean Beauty Seafoods sells to residents and others in 55 gallon containers.		
Cooperative Purchase	Not interested. Fuel vendors are not able to get a tug and barge close to Akhiok's dock. It's not feasible for a vessel carrying a large amount of fuel for several villages coming into Akhiok.		

Sources: (3). **Notes:** 1/ Based on FY2014 PCE data (7). 2/ 2010 Alaska Energy Pathway estimate has not been updated or verified (4).

ENERGY PLANNING

BIOMASS
Low Potential – The 2010 Alaska Energy Pathway plan identified wood as one of the renewable resources available to Akhiok, but the area is dominated by moist tundra and grasses with very few tall brush areas and trees, although some stands of alder are present **(13)**. Driftwood provides another source of wood biomass, but may not exist in sufficient quantity for a community-scale project (50 cords per year) or its harvest may be in competition with local use for home heating. The area has one seafood processor (Ocean Beauty in Alitak) that generates its own power. Ocean Beauty produces fish fillets and canned salmon at Alitak rather than fish meal making it less feasible to produce biodiesel from fish waste. There are no class 1 landfills that would support a solid waste heat or combined heat and power project.

DIESEL EFFICIENCY AND HEAT RECOVERY	
High Potential - Diesel currently is used to generate 100% of Akhiok's electricity, but with diesel 60% of energy is lost to heat even in the most efficient generators. Heat recovery can recover 10-20% of the energy in diesel fuel by providing heat to nearby buildings and another source of revenue for the utility. Measures that improve diesel efficiency and implement heat recovery provide the opportunity for significant fuel savings that will lower the cost of generation and improve the community's ability to compete successfully for new renewable energy grants or financing.	
Issue: Akhiok's power plant has a diesel efficiency of 10.3 kWh/gallon, which is on the low side for rural communities in the region.	**Opportunity:** Improving efficiency by 10% (to 11.4) would save over 2,400 gallons of fuel per year and $9,619 in avoided fuel costs. Improving diesel efficiency to 13.0 would save nearly 5,500 gallons of fuel and $22,500 in avoided fuel costs per year.
Issue: The 2012 RPSU survey indicates that Akhiok's distribution system is in poor repair, the powerhouse has poor lighting and ventilation, and there are other security and high risk health and safety issues.	**Opportunity**: Before adding renewable energy resources like wind, the existing generation and distribution system should be brought into good repair and efficiency measures implemented: Balance three phase; address safety risks; address meter installation, corrosion, and condition problems; repair conductor where exposed; and repair improperly installed transformers. **(14)**
Issue: The John Deere 4045 gensets with cooled EGR and variable geometry turbochargers have not proven to be reliable in many rural applications.	**Opportunities**: Ask AEA powerhouse program staff for a recommendation on replacing one or more engines with a rebuilt 4045, probably a marine configuration, that meets EPA requirements and will provide better reliability and efficiency. Consider future plans for integrating renewable resources when designing improvements to the existing system.
Issue: Heat recovery has not been implemented at the Akhiok power plant. The power plant is located ¾ mile from town, limiting the current benefits of heat recovery especially with small loads.	**Opportunity**: When a powerhouse upgrade is planned, assess the feasibility of moving the plant closer to the school or other community heating loads. The 2010 Alaska Energy Pathway model estimated 464 MMBTU in energy could be captured and used to offset space heating in Akhiok.

DIESEL EFFICIENCY AND HEAT RECOVERY	
Issue: FY13 Utility rate ($0.45/kWh) appears to be less than fuel costs ($0.48/kWh) and less than combined (fuel and non-fuel) generation costs of $0.51/kWh.	**Opportunity**: Increase electric rates to cover fuel and non-fuel expenses.
Issue: Operator proficiency and system maintenance are very important to efficiency. Funders also want to see that diesel systems are well maintained and operating efficiently before funding new renewable generation projects. In the 2012 RPSU study, operator proficiency was rated as unacceptable in all areas. (8)	**Opportunity**: Have operators trained at AVTEC unless this has already been done. There is no cost for instruction, lodging and per diem for the 2-4 week course. The community is responsible for travel and must have an alternate power plant operator in the interim.
Resources: **State:** AEA Powerhouse and Electrical Distribution Upgrades Program, RPSU program, Circuit Rider program, Power Plant Operator Training. **Federal**: Denali Commission Training Fund.	**Costs: Heat Recovery:** $200,000 and up. **AVTEC training**: Travel costs to Anchorage. **Savings**: **Diesel Efficiency**: $9,619 to $22,500 per year in avoided fuel costs (see above).

INTERTIE
Low Potential – Akhiok is too far from the nearest community to make an electrical transmission project feasible with current technologies. Costs for interties in rural Alaska are estimated at $400,000 to $500,000.

EMERGING TECHNOLOGIES
Unknown – Tidal or ocean power resources have not been identified in the waters near Akhiok, but more detailed resource mapping is likely to occur as these technologies continue to develop. Research and demonstration projects in these and other emerging energy technologies, such as heat pumps, low-power HVDC transmission, and flywheel energy storage systems, should be monitored to assess their potential for providing a local energy solution.

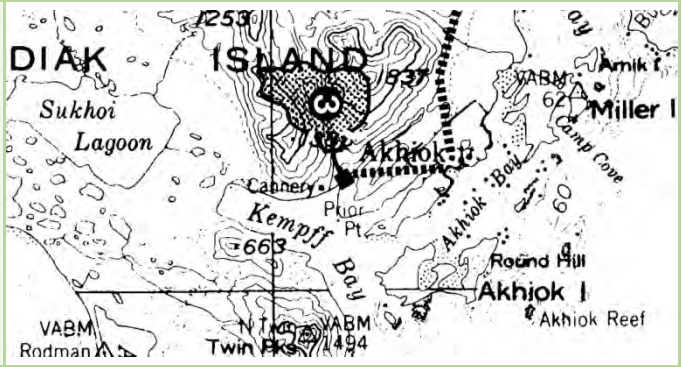
ENERGY EFFICIENCY AND CONSERVATION	
High Potential – Since the cheapest kilowatt or gallon of fuel is the one you don't have to buy, there is high potential to save on energy costs by actively promoting additional residential and commercial EE&C and by auditing public buildings and facilities to identify potential savings.	
Issue: Nearly three-quarters of the community's housing stock (including vacant units) was built before 1980. Housing of that age in the region typically is rated at only 2 or 2-star-plus, with energy costs that are 50-75% higher than a 4-star-plus or 5-star home built in the 2000s. About 42% of occupied homes in Akhiok have been weatherized since 2008.	**Opportunity**: Encourage remaining residents who are income-eligible to weatherize through AHFC's or KIHA's programs. For owner-occupied homes, even if already weatherized, there may be opportunity for additional savings through AHFC's HER program.
Issue: No Akhiok residents have participated in AHFC's Home Energy Rebate program. There are no income limits, but the house must be owner occupied.	**Opportunity**: Encourage at least three homeowners to sign up online for AHFC's Home Energy Rebate program in order for AHFC to pay a rater's travel cost to the community. To date, HER has provided higher energy savings (35%) per home compared with weatherization programs in the region (19% savings).

ENERGY EFFICIENCY AND CONSERVATION	
Resources: State: AFHC Home Energy Rebate, Weatherization, Roving Energy Rater. **Federal**: U.S. HUD NAHASDA Grants through KIHA. **Regional:** EE&C Coordination through KANA (pending successful EDA grant application)	**Costs: State/federal**: Weatherization: $30,000 per home in rural Alaska (including transportation, logistics, overhead and health and safety measures). Home Energy Rebate: $4,800 (average homeowner rebate). **Local/regional:** Outreach and coordination costs (not known). **Annual Savings**: Energy**:** 171 MMBTU. Fuel (gallons): 1,230. Fuel (cost): $6,053.
Issue: Based on 4 months of data, residential electrical users are close to their 500 kWh PCE monthly limit in winter, on average, and some may be going over. Since the community has a relatively high base electricity rate ($0.45/kWh), the cost to residential customers and community facilities exceed that amount.	**Opportunity**: Focus on lowering residential electrical consumption through education to promote conservation behaviors and/or the installation of TED Smart meters in households so residential customers know when they exceed 500kW. Train local youth to provide education and technical support.
Resources: Rural CAP: Energy Wise. **REAP**: AKEnergySmart Curriculum. **AEA** Energy Hog school visits.	**Costs:** Energy Wise: $2,000 per home (requires private partnership). TED meters: Not known. AKEnergySmart Curriculum is free. Cost for training teachers is not known.
Issue: There is no record of commercial or community energy audits or energy efficiency upgrades having been performed, yet nearly half of electric sales are to commercial and public facility customers. Based on 4 months of winter data, Akhiok's commercial customers in particular are heavy energy users compared with other rural communities. Energy efficiency audits and upgrades would especially benefit commercial users, who do not get the benefit of the PCE subsidy.	**Opportunity**: There are several state and federal programs to help finance audits and/or energy efficiency improvements. For Community Facilities: Apply for a whole village energy retrofit to audit and upgrade community facilities and infrastructure. For Commercial customers: Encourage local business owners to apply to AEA's Commercial Building Energy Audit (CBEA) program and follow through on the most cost-effective recommendations. Even if programs only cover audit costs, EE&C paybacks are generally short enough the most cost-effective upgrades worth doing rather than waiting for potential future funding.
Resources: **State:** CBEA (commercial enterprises), Alaska DEED Capital Improvements Program (schools). Alaska DCCED Alternative Energy and Conservation Revolving Loan Fund (public and commercial facilities). AHFC Alaska Energy Efficiency Revolving Loan Program (public facilities). **Federal:** USDA RD Rural Energy for America Guaranteed Loan Program (small business), Federal Tax Deduction for Commercial Buildings. DOE-IE START Alaska, other Tribal energy programs.	**Costs:** An investment of $6 to 7 per square foot is typically needed to achieve a 30% energy savings on non-residential buildings, resulting in payback periods of 5-6 years **(15)**. **Savings**: Expect 10-15% annual savings on public facilities EE&C improvements from making only behavioral changes, 15-25% savings if making all the most cost-effective changes, and 25-35% savings if all recommended energy improvements are completed.
Issue: Akhiok has replaced 5 or its street lights with energy efficiency LEDs. It is not known if the community has additional public outdoor lighting that could be upgraded for additional savings.	**Opportunity**: If Akhiok has more outdoor lighting that uses older, less-efficient technologies (e.g. high or low pressure sodium or mercury vapor lamps), seek funding to replace with LED lamps.

ENERGY EFFICIENCY AND CONSERVATION	
Resources: See *Project Financing* section in Volume I for programs that include energy efficiency.	**Costs:** Estimated at $1,000 per bulb in capital costs. $60/bulb in annual electrical usage. **Savings**: Not known.
Issue: Sanitation systems are one of the single largest energy uses in rural communities, accounting for 10% to 38% of community energy use, depending on system type and climate zone. Akhiok is in the process of installing a new modular water treatment plant that it hopes will cut down on electricity use.	**Opportunity**: Depending on "out of the box" efficiency of new modular plant, assess need for energy efficiency improvements.
Resources: Tribal: ANTHC. **Federal**: EDA	**Costs:** Not known. **Savings** of $10,000 per year have been achieved in arctic communities. Savings may be lower in Kodiak region due to milder climate.

FOSSIL FUELS
Low Potential – Coal, oil and gas are not known to occur in large quantities in the Kodiak region. Coal beds on Kodiak Island are believed to be thin and likely not an economic resource. The geology also makes it unlikely that commercial quantities of conventional or unconventional oil and gas resources will be discovered. **(16)**

GEOTHERMAL
Low Potential – There are no known geothermal resources in Kodiak region **(16)**. Ground source heat pumps have high capital costs and are typically economic only where heating costs are high and electric rates are low.

HYDROELECTRIC	
Medium Potential —No hydropower screening studies have been done since the early 1980s for Akhiok. The most promising resource in early screening was a run-of-river project 2-miles west of Akhiok on Kempff Bay Creek. With no storage, output was estimated at 474 to 710 MWh annually depending on water levels. Installed capacity was estimated at 137 kW. Environmental concerns include salmon spawning and brown bears in the drainage area. (17) (18)	
Issue: A hydro project has the potential to meet nearly all of Akhiok's needs, with diesel used for only for backup. However, the most recent hydroelectric studies on file for Akhiok are from the 1980s when hydro was found to be less economic than diesel generation at then current oil prices.	**Opportunity**: If community interest exists, a new hydro reconnaissance study is needed to estimate costs and benefits at current prices and loads.
Issue: While hydropower has high capital costs compared with other renewable resources, project lifespans can be 50 to 100 years with O&M costs similar or lower than diesel. Hydro power is easier to integrate with small diesel loads than wind energy.	**Opportunity**: Apply for an RE Fund grant to review all renewable energy options including wind and hydro.

HYDROELECTRIC	
Resources: State: AEA Hydroelectric program, Renewable Energy Fund, Power Project Loans, Community Development Block Grants. **Federal**: Economic Development Administration grants, USDA Rural Development grants, Indian Development Block Grants. **Private**: Partnering with a for-profit entity to take advantage of new market tax credits.	**Costs**: $75,000 hydropower pre-feasibility study or $125,000 for broader RE screening study.

SOLAR	
Medium Potential – Solar does not offer a utility-scale solution in Alaska, but solar PV and solar thermal projects can provide relief for individual homes and facilities, especially those off the grid or that have high summer electric usage. Kodiak receives an average of 3 to 3.5 kWh/m^2/day of solar radiation annually, with most coming in April to August. A 4 kW fixed-tilt solar PV array on a building in Kodiak can produce 3,373 kWh of AC power per year if the solar panels are kept free of snow. At Akhiok's non-PCE rate of $0.45/kWh, that is the equivalent of $1,518 of power purchased from the utility.	
Issue: If more households or businesses meet some of their electrical needs through self-generation, the challenges of integrating new utility-scale renewable resources into a small load intensify.	**Opportunity:** Using solar technologies to reduce space and hot water heating costs may be more economical than using solar energy to generate electricity and will not reduce the utility's electric load. However, these systems are significantly more complex to set up and maintain than PV arrays and so having trained and knowledgeable operators is important.
Resources: Federal: NREL (funding, technical support), PVWatts Viewer (calculates potential solar energy production and cost), EPA IGAP, DOE-IE Tribal energy programs. **Other**: Alaskasun.org **(**information, contractors and supplies)	**Costs:** Capital costs: $3 to $10 per watt depending on who does the installation, making the installed cost of a 4kW system $12,000 to $40,000. Costs for a system off the grid need to include the cost of battery storage. **Savings**: Not known.

TRANSPORTATION INFRASTRUCTURE	
Medium Potential – Akhiok has the highest heating fuel cost in the region, contributing significantly to high energy bills for residents and businesses. The transportation component of fuel costs can be reduced by investing in marine infrastructure that allows fuel delivered by barge to be off-loaded safely and efficiently. A deep water dock, a road to the cannery at Alitak, and additional fuel storage in Akhiok have all been named as local priorities with the potential to lower fuel storage and transportation costs. **(19)**.	
Issues: There is no deep water dock or harbor in Akhiok, and no regular barge or other water freight service. Fuel for electric generation is brought in by landing craft increasing the costs and risks of fuel delivery. Once at the landing, fuel must be transported 2 miles to the tank farm. Fuel for home heating is purchased by the barrel from the cannery at Alitak at considerable expense. A permanent dock has been proposed in several past community and regional plans.	**Opportunities:** A dock that can accommodate barges would result in increased competition from fuel vendors and lower delivery costs. A study to assess the technical and economic feasibility of a project and update any past cost figures is the next step. If feasible, a permanent dock for Akhiok should be prioritized in regional transportation plans.

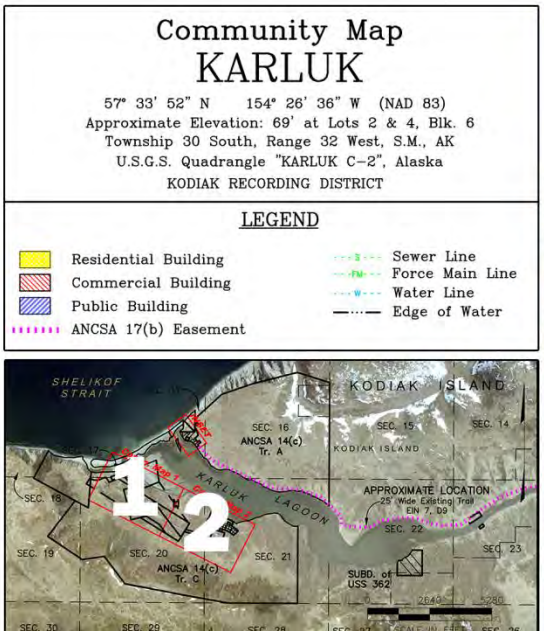
Issues: At $7 per gallon, heating fuel costs are 21% higher than average for rural communities in the region. Heating fuel is purchased by residents and others in 55 gallon drums from Ocean Beauty in Alitak.	**Opportunities:** By contrast, fuel purchased by the city and stored at the tank farm for utility use has recently been purchased at $3.74 per gallon. If the city were able to buy and store heating fuel for local distribution, it would create local job(s) in fuel distribution and lower the high cost of space heating for residents. The city currently uses all of its storage capacity to meet utility needs. Additional storage would be needed to accommodate heating oil. A feasibility study could estimate costs and benefits.
Issues: Air transportation to and from Akhiok is frequently unavailable for extended periods of time due to severe weather. The length of the runway (3,120 ft.) limits the size of planes that can use the airstrip, and the lack of Instrument Flight Rules (IFR) increases the frequency of weather delays and closures.	**Opportunities:** Expansion of the runway to accommodate larger aircraft would lower transportation costs for passenger and freight. The community has identified the need for runway improvements, including upgrading to IFR, as a priority in past planning documents.
Resources: State: Alaska DOT&PF STIP, DCCED Designated Legislative Grants. **Federal**: Denali Commission, EDA. **Regional**: Kodiak Island Borough, SWAMC.	**Costs:** $550,000 for feasibility and design costs (based on Larsen Bay's proposed dock study). **Savings**: It is difficult to estimate the savings on bulk fuel costs since fuel prices fluctuate daily on the world market and vendors' cost data is proprietary.

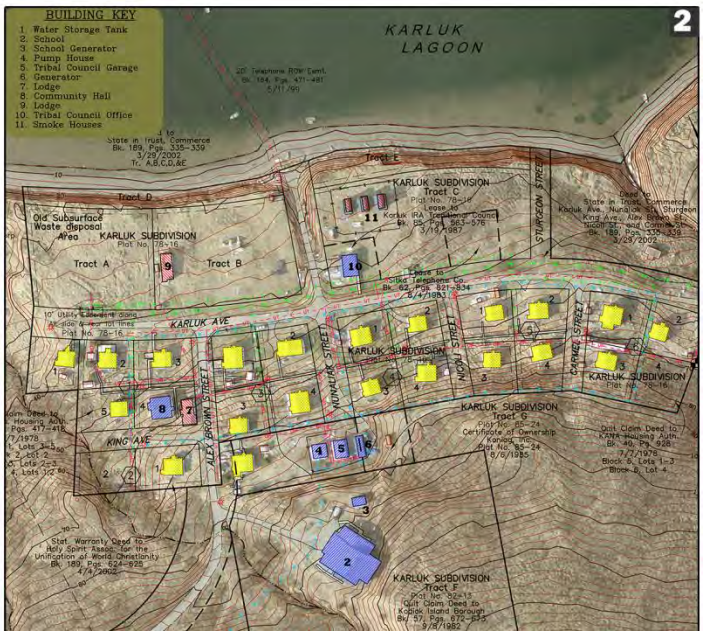
Wind	
Unknown –Wind is one of three renewable resources recommended for reducing fossil fuel dependence in Akhiok in the 2010 Alaska Energy Pathway plan, and it has been mentioned as a community priority. A wind metering study has not been completed, but wind models indicate a variable wind resource of class 2 to 6.	
Issue: There is no wind metering data on file with AEA's Wind Energy program. Past modeling indicates a variable class 4 resource, with class 2 winds at the airstrip and class 6 on the hill west of town.	**Opportunity:** AEA's Anemometer Loan Program supplies meteorological towers, data logging equipment, and technical support to utilities and communities interested in wind power. A year's worth of data must be collected before a site and system can be recommended.
Issue: As in other small communities, a wind project is challenged by small diesel electric loads. Adding a significant amount of wind power to a diesel system with average loads of 25 kW will reduce diesel performance and fuel efficiency to low levels.	**Opportunity:** A battery storage system is recommended to integrate wind into a diesel system with a small load. Statewide there is also interest in using wind output for heating, which is more tolerant of power swings and easier to store. "Wind to heat" can also have challenging economics though, so feasibility work is needed.
Issue: Akhiok's John Deere 4045 generators are not modifiable for electronic fuel injection, which is needed for wind integration.	**Opportunity**: If the community decides to move forward with a project after completing a wind study, improvements to the diesel system will need to be designed based on the results of the wind resource study and analysis of hourly electrical load data.

Issue: From both an operations and a financing perspective, wind energy makes the most sense to integrate when the rest of the power generation and distribution system is in good condition and operating efficiently. Funders want to see that the diesel power plant is well run before funding new renewable generation projects.	**Opportunity:** Diesel efficiency recommendations and safety upgrades to the power plant and distribution system should be made before implementing wind energy in Akhiok. The community's recent reentry to the PCE program with its reporting requirements is a positive development. Because of the complexity of operating a wind-diesel system, especially with small loads, AEA recommends singing a wind O&M contract with an experienced wind energy contractor.
Resources: **State**: AEA Anemometer Loan Program, Renewable Energy Fund, Power Project Loans, Community Development Block Grants. **Federal**: Economic Development Administration grants, USDA Rural Development grants, Indian Development Block Grants. **Private**: Partnering with a for-profit entity to take advantage of new market tax credits.	**Costs:** Feasibility study: $70,000.

Community and Regional Plans		
Year	Report Title (Author)	Community-specific, Energy-related Recommendations
2013	Kodiak Rural Regional Comprehensive Economic Development Strategy (Kodiak Area Native Association)	1. Feasibility study for alternative energy to replace expensive diesel generation. 2. New water treatment system, holding tanks and distribution lines; system using alternative energy 3. Expansion of to accommodate larger aircraft. Needs IFR and portable lighting for use during emergency evacuations.
2009	Kodiak Island Borough Regional Energy Plan (Kodiak Island Borough Community Development Department)	1. Install wind-metering tower to determine wind potential. 2. Funding for a bigger more efficient generator. 3. Possible studies on hydro-tidal energy sources.
2008	Kodiak Island Borough Comprehensive Plan Update (Kodiak Island Borough)	1. Explore options for alternative energy to offset the high cost of fuel. These could include wind, hydro, and solar power.
2003 Update to 2001	Kodiak Region Comprehensive Economic Development Strategy - Revised (Kodiak Chamber of Commerce)	1. Permanent dock facility. 2. Electric power system upgrade.
2002 Update	Akhiok Community Plan	*Need copy to review*
1986	Akhiok Comprehensive Plan and CIP (Kodiak Island Borough Community Development Department)	1. Construction of a permanent dock facility. 2. Purchase a 100 kW generator to replace the 55 kW unit. 3. Build a road from Akhiok to the cannery to allow for safer transportation of fuel between the city and cannery.
1983/1981	Reconnaissance Study of Energy Requirements and Alternatives for Akhiok, King cover, Larsen Bay, Old Harbor, Ouzinkie, Sand Point (CH_2M Hill)	1. Continue central diesel generation to meet village and new school loads. 2. Some community preference for a Kempff Bay Creek hydro plant. 3. Study feasibility of heat recovery at power plant and school.
1980	Regional Inventory and Reconnaissance Study for Small Hydropower Projects (Department of the Army, Alaska District, Corps of Engineers)	Three sites analyzed for hydropower potential. Best site appears to be the one at Kempff Bay Creek (though unnamed in study) with annual stream flow estimated at 9.7 cfs; net head 185 ft.; and potential capacity from 200 kW with two 100 kW turbines.

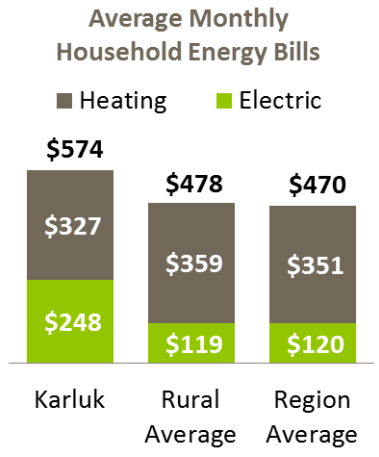
KARLUK



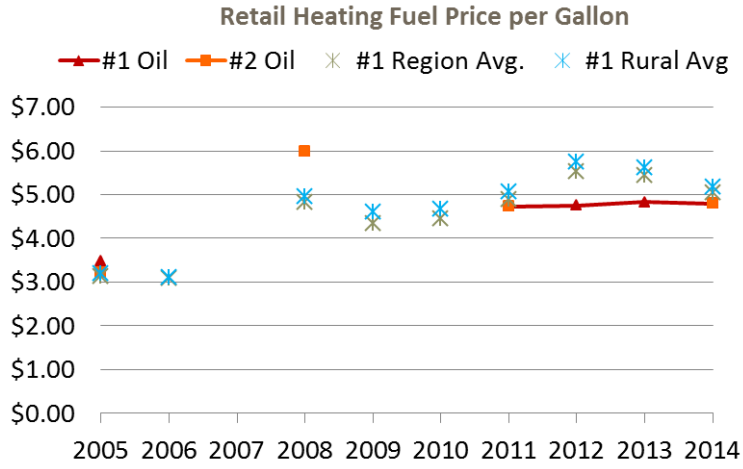


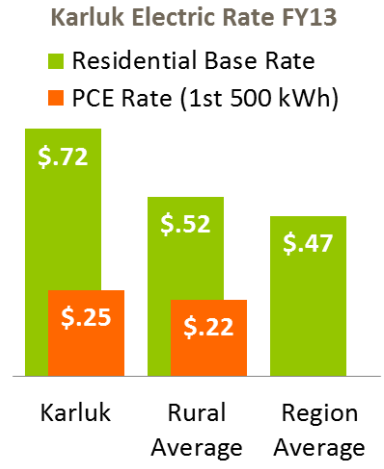
Community Vision	Respect the customs of our Alutiiq culture and empower our community with our rich traditions to sustain our village into the future.	
Community Energy Priorities[1]	Priorities	Concerns
	Replace existing generators with larger capacity units	- Housing; not enough homes in the community - Grant assistance; need people to write grant applications for energy and other community needs - Action needed on mouth of river; outside beach set up for landing craft, but river mouth is changing, affects all projects
	Implement energy efficiency programs	
	Continue ANTHC efforts to improve water systems	
	Install a new MET tower to study wind potential	
Local Stakeholders Groups	Karluk IRA Council (federally recognized tribe)	
	Alutiiq Power & Fuel Company (utility, bulk fuel sales, landfill operator)	
Energy Champions[1]	Tribal Council, Joyce Jones (Utility manager), Plant operators	
Sources: **(20) (2) (21)**. **Notes**: 1/ Based on Phase II input.		

TOTAL ENERGY USE			
Electrical Generation	**Diesel**: 264 MWh **Renewable**: 0	**Sold**: 240 MWh	**Line Loss**: 7.8% **Powerhouse**: 1.1%
Community Load	**Average**: 19 kW **Peak**: 41 kW (4)	**Electric Customers**	**Residential**: 14 **Community Facilities**: 2 **Other (Non-PCE)**: 14
Annual Fuel Use	**Electric**: 23,759 gals.	**Space Heating:** 14,226 gals (4)	**Transportation**: 3,805 gals (4)
Fuel Price	**Electric**: $4.37/gal. (FY2013)	**Heating**: $4.92/gal of #1 Oil (Jan. 2014) (5)	**Transportation**: NA

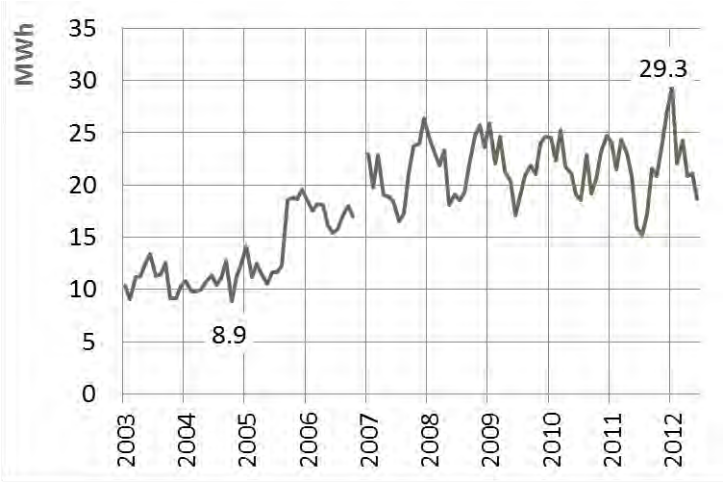


Heating Fuel Cost (5)

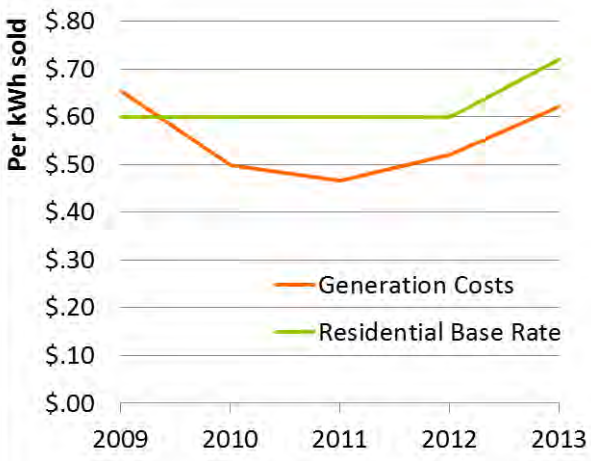
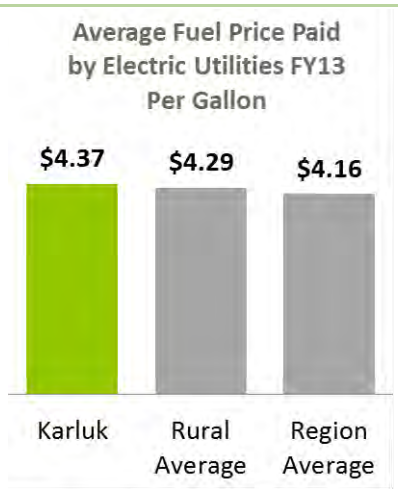
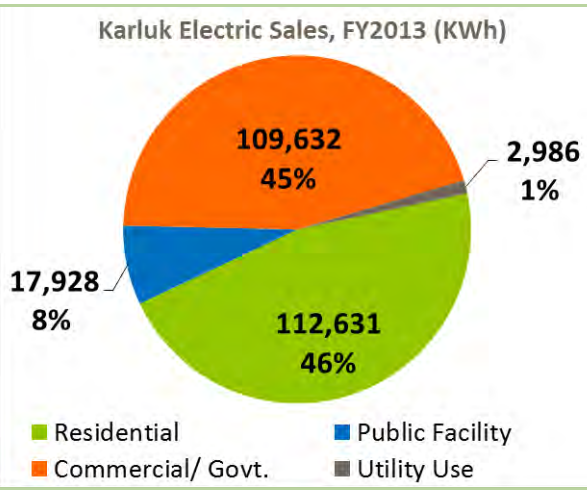
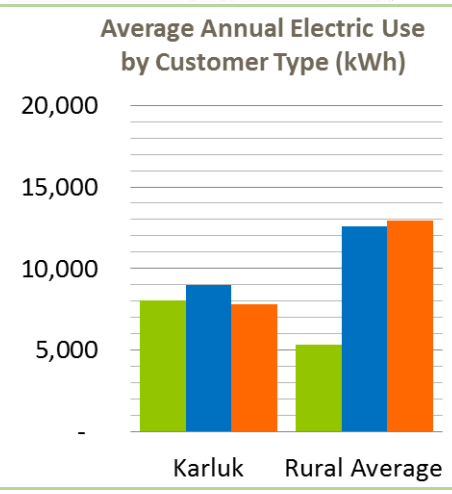




Electrical Generation (5)



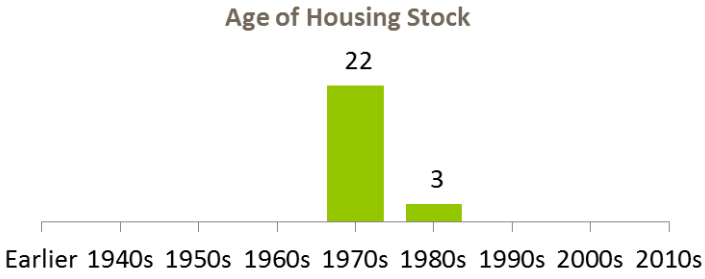
Sources (except as noted): **(7)**

ELECTRIC GENERATION			
Utility	Alutiiq Power and Fuel Company		
PCE (level)	Active ($0.47/kWh)	RPSU Upgrade	Completed
Diesel Capacity	**G1**: 70 kW **G2**: 70 kW	Renewable Capacity	None
Diesel Generators	**G1**: John Deer 4045 - Fair **G2**: John Deer 4045 - Fair	Load Sizing	Properly sized
		Load Imbalance	10-25%
Diesel Efficiency	11.1 kWh/gallon	Switchgear	Semi-automatic synchronizing switchgear
Residential Rate	**Effective**: $0.25/kWh (1st 500 kWh). **Base**: $0.72/kWh	Cost per kWh Sold	Fuel: $0.43; Non-Fuel: $0.19 Total cost: $0.62
Operator Proficiency	**Acceptable:** Meter reading, logs, routine & scheduled maintenance. **Unacceptable:** Maintenance planning	Heat Recovery	No (An older report lists system as installed but not operational, but this has not been verified.)
Known Issues	Airport feeder grounded out, unknown location. 7200V step up behind power plant. Outage causes: lift pump failures; overload during school **(8)**. Old home wiring, street lights may contribute to line loss. Three houses on electric heat may contribute to load imbalance **(21).**		
Generation Costs			
Electric Sales by Customer Type			
Sources (except as noted): **(7) (8)**			

ENERGY EFFICIENCY AND CONSERVATION

Residential

Occupied Housing Units	Housing Type, including Vacant	Average Home Size (est.)[1]	Avg. HH Size / Overcrowding	Median HH Income	Energy Cost as a % of Income
16	27 Single Family	1,056 sf	1.8 / No	$37,083	19%

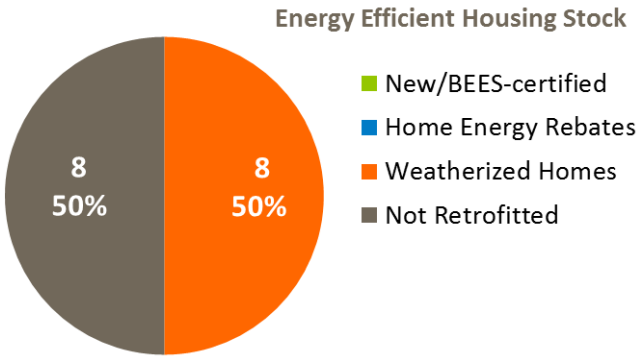


Estimate Annual Energy Use per Home	Average Annual Home Energy Bill
129 MMBTU	$6,894

Older homes are typically less energy-efficient than newer homes, due to improvements in building technology and energy efficiency over time.

Annual Home Energy Savings Achieved	Additional Annual Home Energy Savings Opportunity	Percent of Residential EE&C Work Remaining
190 MMBTU 1,364 gals. $6,709	200 MMBTU 1,438 gals. $7,076	50%

Assumptions: Average energy savings for region based on 2008-13 ARIS data (35% HER, 18% AHFC weatherization projects). Retail fuel cost: $4.92/gal.



Non-residential

No. of Public/ Commercial Buildings[2]	Types of Buildings	Est. Annual Energy Use per Building[3]	Buildings Audited	EE&C Measures Identified	EE&C Savings Achieved
16	See Appendix B	1,178 MMBTU	None Reported	NA	$0
Street Light Number	**Street Lighting Type**	**LED Street Lighting Upgrade**	**Street Lighting Remaining Opportunity**	**Estimated Cost of LED Street Light Retrofit[4]**	**LED Street Lighting Annual Energy Savings[4]**
Not Known	Not Known	No	100%	$5,000 to $18,000 total or $1,000 per light	4,800 to 7,500 kWh / $1,400 to $2,200
Water & Sewer System Type / No. of Homes Served	**Water and Sewer Rates**	**Estimated Annual Water & Sewer Energy Use[1]**	**Sanitation System Energy Audit Performed**	**Estimated Cost of Water & Sewer EE&C Upgrades**	**Estimated Annual Water & Sewer Energy Savings[5]**
Piped 16 Homes	Residential: $25/mo. Other: $100/mo.	164 MMBTU 983 gals. 8,072 kWh	No	Not Known	16 MMBTU 171 gals. 807 kWh $842

Sources: (9) (10). **Notes**: 1/ Calculated based on Energy End-Use Study data (11). 2/ Based on number of electric rate payers. 3/ Calculated based on Energy End-Use Study and 2013 Alaska Housing Assessment data (11) (12). 4/ Based on ARIS data for communities of 50 to 100 people. 5/ Assumes 10% savings on fuel and electric.

DIESEL EFFICIENCY AND HEAT RECOVERY					
Annual Savings from a Diesel Efficiency of 13.0 kWh/gal.[1]	Heat Recovery Installed at Power Plant	**Buildings Heated with Waste Heat**	Additional Heat Recovery Opportunity	**Estimated Cost of Water Jacket Heat Recovery**	**Est. Annual Savings from Water Jacket Heat Recovery**
3,468 gals. $15,156	No	0	Pumphouse?	Capital cost: $200,000 and up	337 MMBTU[2] or 10 to 20%

BULK FUEL			
Capacity	**Utility**: 40,000-50,000 gals. **School**: NA	Fuel Purchase (22)	Karluk participates in the Bulk Fuel Revolving Loan Program. **#1 Oil:** 22,500 gals. **#2 Oil:** 22,500 gals.
Bulk Fuel Upgrade	Completed 2004	Vendors	Petro Star (City of Kodiak)
By Barge	Fuel is delivered by barge. There are no docking or mooring facilities, and cargo must be offloaded using landing craft. A dock is being reportedly being planned (Need to confirm.) **(13)**		
By Air	In 2011, the village suffered a fuel shortage and had to fly drums of fuel in daily at a high cost due to the 2,400 ft. runway which cannot accommodate fuel cargo planes. **(23).**		
Local Delivery	Fuel is delivered to residents by barge and truck. Gas is shipped in and stored in barrels **(23)**.		

Sources: (21) (22). **Notes**: 1/ Based on FY2013 PCE data (7). 2/ 2010 Alaska Energy Pathway estimate has not been updated or verified (4).

ENERGY PLANNING

BIOMASS
Low Potential - Lack of woody biomass; no sawmills, class I landfills (for solid waste) or fish processors.

DIESEL EFFICIENCY AND HEAT RECOVERY	
High Potential - Diesel currently is used to generate 100% of Karluk's electricity, but 60% of energy is lost to heat even in the most efficient diesel generators. Measures that improve diesel efficiency and implement heat recovery provide the opportunity for significant fuel savings that will lower the cost of diesel generation. Funders also want to see that diesel systems are well maintained and operating efficiently before funding new renewable generation projects.	
Issue: Karluk's power plant has a diesel efficiency of 11.1 kWh/gallon—slightly lower than average for the region. The John Deere 4045 gensets with cooled EGR and variable geometry turbochargers have not proven reliable in many rural applications. Katolite generators are also not set up for wind integration.	**Opportunity:** Replacing one or more engines will provide better reliability and efficiency. Work with AEA powerhouse program staff to design a system that improves reliability while accommodating future renewable integration plans. Analyze pros and cons of increasing distribution voltage to 2400V **(14)**.
Issue: Gensets are less efficient when run at low capacity. Karluk is running at 43% of load on average. Integrating wind would increase the challenges of operating gensets with small loads, reducing fuel efficiency.	**Opportunity:** A battery storage system is recommended to mitigate some of the issues with integrate wind into a diesel system with a very small load **(24)**.
Issue: Operator proficiency and system maintenance are very important to diesel efficiency. In the 2012 RPSU study, operator proficiency was rated as Acceptable in all areas except Maintenance Planning, which was rated unacceptable (8).	**Opportunity**: Improve maintenance planning. Provide all operators with additional training to increase proficiency to Good or Excellent levels. There is no cost for instruction, lodging and per diem for the 2-4 week course. The community is responsible for travel and must have an alternate power plant operator in the interim.
Issue: According to past reports, a heat recovery system was installed but never made operational. Heat recovery was included in Karluk's Round 6 & 7 RE Fund application, but the project was not funded primarily due to questions about the wind energy portion of the application. The REF grant application proposed generating up to 270 MBH (0.27 MMBTU/hour) of recovered heat from both gen-sets to heat the school, tribal council office, city hall, and lodge in a 1,000 ft. hydronic heating loop.	**Opportunity**: Analyze the feasibility of implementing water jacket heat recovery at the power plant. Heat recovery can recover 10-20% of the energy in diesel fuel and provide another source of revenue for the utility. While the small electric load will limit the amount of heat available, a heat loop from the power plant could provide 337 MMBTU to nearby community buildings, according to one analysis **(4)**.
Resources: State: AEA Powerhouse and Electrical Distribution Upgrades Program, RPSU program, Circuit Rider program, Power Plant Operator Training. **Federal**: Denali Commission Training Fund.	**Costs: Heat Recovery:** $200,000 and up. **AVTEC training**: Travel costs to Anchorage. **Savings**: Improving diesel efficiency by 10% (to 12.2 kWh/gal.) would save almost 2,200 gallons of fuel and $9,419 in avoided fuel costs per year.

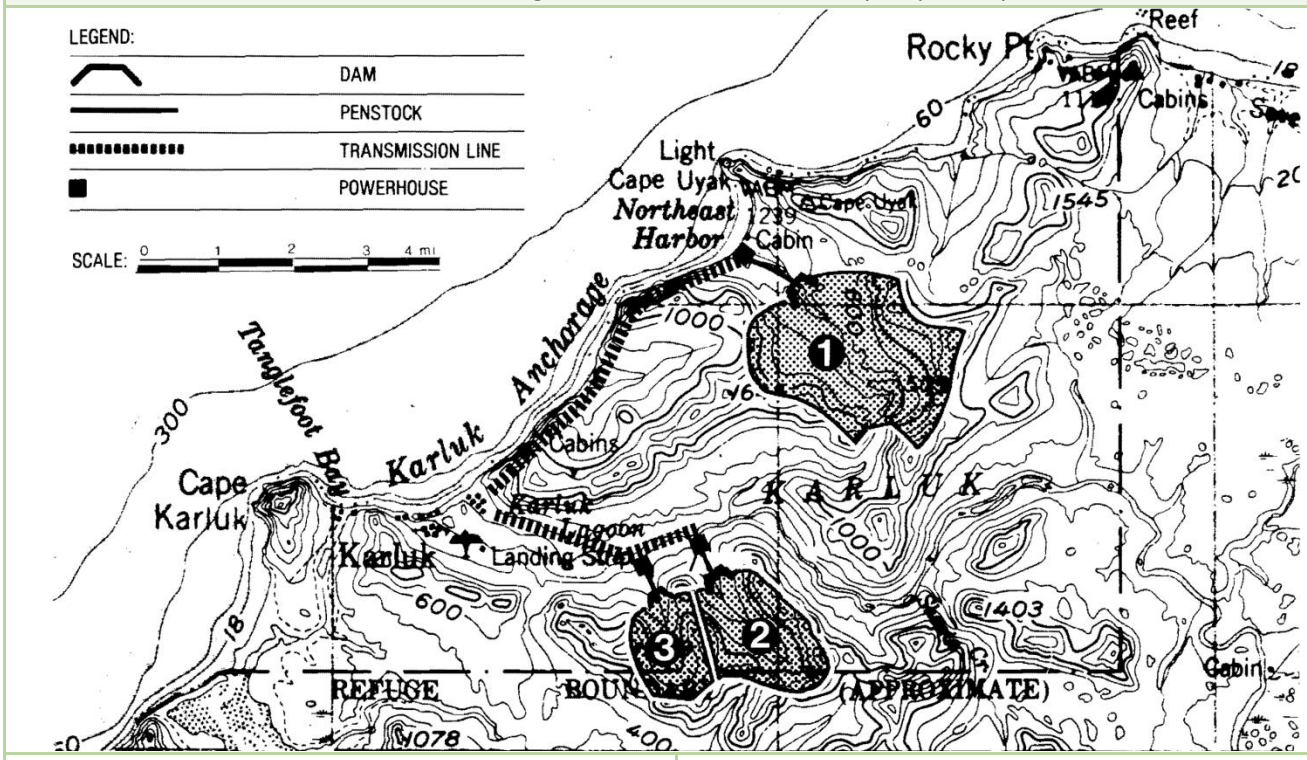
EMERGING TECHNOLOGIES
Unknown – Significant tidal or ocean power resources have not been identified in southern portions of Shelikof Strait, but research and demonstration projects in these and other emerging energy technologies, such as heat pumps, low-power HVDC transmission, and flywheel energy storage systems, should be monitored to assess their potential for providing local energy solutions.

ENERGY EFFICIENCY AND CONSERVATION	
High Potential – The cheapest kilowatt or gallon of fuel is the one you don't have to buy. There is high potential to save on space heating costs and lower electric bills by actively promoting additional residential and commercial EE&C and by having public buildings and facilities (street lights and water/sewer system) audited to identify potential savings.	
Issue: The community's housing stock almost all dates from the 1970s. Housing of that era in the region typically is 2-star-plus, with energy costs that are 40-50% higher than a 4-star-plus or 5-star home built since 2000. About 50% of homes in Karluk have been weatherized with AHFC or NAHASDA funds.	**Opportunity**: Encourage any remaining residents who are income-eligible to weatherize through AHFC's or KIHA's programs. (Owner-occupied homes already weatherized with NAHASDA funding may be able to achieve additional savings through AHFC's Home Energy Rebate program, which typically achieves higher savings rates.)
Issue: No Karluk residents have participated in AHFC's Home Energy Rebate program, which provides higher energy savings (35%) per home compared with weatherization programs in the region (18% savings) and has no income limits, but requires the house to be owner occupied. Almost all savings are in heating, so increased participation will not reduce electrical loads.	**Opportunity**: AHFC's Roving Energy Rater Program will send a home energy rater to a small community if there 3 homeowners sign up for an audit. A community can increase HER participation rates by actively promoting the program and encouraging residents to sign up or helping them to do so. KANA has applied for an EDA grant to help coordinate and promote EE&C in the region.
Resources: State: AFHC Home Energy Rebate, Weatherization, and Roving Energy Rater programs. **Federal**: U.S. HUD NAHASDA Grants through KIHA. **Regional:** EE&C Coordination through KANA (pending successful EDA grant application)	**Costs: State/federal**: Weatherization: $30,000 per home in rural Alaska (including transportation, logistics, overhead and health and safety measures). Home Energy Rebate: $4,800 (average homeowner rebate). **Local/regional:** Outreach and coordination costs (not known). **Annual Savings**: 200 MMBTU community-wide if all homes not already retrofitted are weatherized. Annual fuel savings are 1,438 gallons and $7,076 in avoided fuel cost per year.
Issue: Residential electrical use per customer is highest in region, while public and commercial building use per customer is lowest in the region. The community has a high base electricity rate, and people are going over the monthly 500 kWh PCE limit in winter.	**Opportunity**: Focus on lowering residential electrical consumption through education to promote conservation behaviors and/or the installation of TED Smart meters in households so residential customers know when they exceed 500kW. Train local youth to provide education and technical support.
Resources: Rural CAP: Energy Wise. **REAP**: AKEnergySmart Curriculum. **AEA** Energy Hog school visits.	**Costs:** Energy Wise: $2,000 per home (requires private partnership). TED meters: Not known. AKEnergySmart Curriculum is free. Cost for training teachers is not known.

ENERGY EFFICIENCY AND CONSERVATION	
Issue: There is no record of commercial or community energy audits or energy efficiency upgrades having been performed, yet there are many state and federal programs to help finance audits and/or energy efficiency improvements. More than half of electric sales are for commercial and public facility customers, who do not get the benefit of the PCE subsidy.	**Opportunity**: Apply for a whole village energy retrofit to audit and upgrade community facilities and infrastructure. Encourage local business owners to apply to AEA's Commercial Building Energy Audit (CBEA) program and follow through on the most cost-effective recommendations. Even if programs only cover audit costs, EE&C paybacks are generally short enough the most cost-effective upgrades worth doing rather than waiting for potential future funding.
Issue: Not all public outdoor lighting is working and wiring issues may be contributing to system line losses. Repairs to existing lights are needed.	**Opportunity**: Rather than repairing existing lights, consider replacing all outdoor lights with energy efficient LED lights.
Resources: **State:** CBEA (commercial enterprises), Alaska DEED Capital Improvements Program (schools). Alaska DCCED Alternative Energy and Conservation Revolving Loan Fund (public and commercial facilities). AHFC Alaska Energy Efficiency Revolving Loan Program (public facilities). **Federal:** USDA RD Rural Energy for America Guaranteed Loan Program (small business), Federal Tax Deduction for Commercial Buildings. DOE-IE START Alaska, other Tribal energy programs.	**Costs:** An investment of $6 to 7 per square foot is typically needed to achieve a 30% energy savings, resulting in payback periods of 5-6 years **(15)**. **Savings**: Expect 10-15% annual savings on public facilities EE&C improvements from making only behavioral changes, 15-25% savings if making all the most cost-effective changes, and 25-35% savings if all recommended energy improvements are completed. **Street Lighting:** Estimate $1,000 per light. Communities with populations of 50 to 100 have achieved annual savings of $2,200 (6,150 kWh) with a investments ranging from $5,000 to $18,000 and average payback of 7 years **(25)**.
Issue: Sanitation systems are one of the single largest energy uses in rural communities, accounting for 10% to 38% of community energy use, depending on system type and climate zone. Karluk's system is very old. Replacing it is a top priority for the community.	**Opportunity**: Assess feasibility of including energy efficiency improvements and possibly heat recovery into the system upgrades. The pumphouse is two buildings away and is currently heated with electricity **(21)**.
Resources: Tribal: ANTHC. **Federal**: EDA	**Costs:** Not known. **Savings** of $10,000 per year have been achieved in arctic communities. Savings may be lower in Kodiak region due to milder climate.

FOSSIL FUELS
Low Potential – Coal, oil and gas are not known to occur in large quantities in the Kodiak region. Coal beds on Kodiak Island are believed to be thin and likely not an economic resource. The geology also makes it unlikely that commercial quantities of conventional or unconventional oil and gas resources will be discovered. **(16)**
GEOTHERMAL
Low Potential – There are no known geothermal resources in Kodiak region **(16)**. Ground source heat pumps have high capital costs and are typically economic only where heating costs are high and electric rates are low.

HYDROELECTRIC
Unknown —Three lowhead sites were identified in a 1980 hydropower screening study, with average annual streamflows of 15.4 cfs (site 1), 7.1 cfs (site 2), and 4.1 cfs (site 3), with net heads of 250 ft., 240 ft., and 405 ft., respectively. Potential capacity was rated at 420 kW, 190 kw, and 180 kW respectively. Because of the small electric load in Karluk, the cost per kWh for all sites was higher than diesel generation costs at the time. Environmental concerns include salmon migration in all streams with hydropower potential. **(18)**



Issue: The most recent hydroelectric studies on file for Karluk are from the 1980s.	**Opportunity:** If community interest exists, a new hydro reconnaissance study is needed to estimate costs and benefits at current prices and loads.
Issue: While hydro projects are often more expensive to develop, project lifespans are longer than other renewable energy projects. Hydro power is also easier to integrate with small diesel loads than wind energy.	**Opportunity:** Apply for an RE Fund grant or other funding to review all renewable energy options including wind and hydro.
Resources: State: AEA Hydroelectric program, Renewable Energy Fund, Power Project Loans, Community Development Block Grants. **Federal**: Economic Development Administration grants, USDA Rural Development grants, Indian Development Block Grants. **Private**: Partnering with a for-profit entity to take advantage of new market tax credits.	**Costs:** $75,000 hydropower pre-feasibility study or $125,000 for broader RE screening study.

INTERTIE
Low Potential – An intertie to Larsen Bay has been looked at in previous studies, which concluded that the cost to construct an 18 to 20-mile intertie between the two communities would exceed potential savings. Currently the PCE-subsidized residential rate in Karluk is lower than in Larsen Bay. A 2009 study estimated Larsen Bay to Karluk transmission costs at $5.19 per kWh, using a rough estimate of $400,000 to $500,000 per mile based on statewide data **(26)**. A 1983 study concluded that the cost of an intertie would be higher than the combined cost of hydro or diesel generation alternatives in both communities **(27)**. While an intertie would theoretically allow wind or hydro resources to be tied in anywhere along the route, development of an energy project on National Wildlife Refuge lands or near the Karluk River (with its Wild and Scenic designation) would face additional environmental concerns and permitting challenges. Local interest in a transmission project is not known.

SOLAR	
Medium Potential – Solar does not offer a utility-scale solution in Alaska, but solar PV and solar thermal projects can provide relief for individual homes and facilities, especially those off the grid or that have high summer electric usage. Kodiak receives an average of 3 to 3.5 kWh/m^2/day of solar radiation annually, with most coming in April to August. A 4 kW fixed-tilt solar PV array on a building in Kodiak can produce 3,373 kWh of AC power per year if the solar panels are kept free of snow. At Karluk's non-PCE rate of $0.72/kWh, that is the equivalent of $2,429 of power purchased from the utility.	
Issue: If more households or businesses meet some of their electrical needs through self-generation, the challenges of integrating new utility-scale renewable resources into a small load intensify.	**Opportunity:** Using solar technologies to reduce space and hot water heating costs may be more economical than using solar energy to generate electricity and will not reduce the utility's electric load. However, these systems are significantly more complex to set up and maintain than PV arrays and so having trained and knowledgeable operators is important.
Resources: Federal: NREL: Funding, technical support, PVWatts Viewer (calculates potential solar energy production and cost), EPA IGAP, DOE-IE Tribal energy programs. **Other**: Alaskasun.org **(**information, contractors and supplies)	**Costs:** Capital costs: $3 to $10 per watt depending on who does the installation, making the installed cost of a 4kW system $12,000 to $40,000. Costs for a system off the grid need to include the cost of battery storage. **Savings**: Not known.

TRANSPORTATION INFRASTRUCTURE	
High Potential - A dock and extended runway would lower the cost of delivered fuel in Karluk. The transportation component of barged fuel costs can be reduced by investing in marine infrastructure that allows fuel to be off-loaded safely and efficiently. The cost of fuel delivery by air is lower in communities with runways over 4,000 ft., which can accommodate larger fuel cargo planes.	
Issues: There are no docking or mooring facilities in Karluk making it difficult to off-load fuel and increasing the transportation component of fuel costs. A dock for Karluk has been proposed in several community and regional plans.	**Opportunities:** A dock that can accommodate barges with safe marine headers for off-loading fuel would result in lower fuel delivery costs and increased competition from vendors. A feasibility study with updated cost estimates is the next step.

Issues: With extreme weather conditions in winter, barge service is limited resulting in fuel shortages and the need to fly in fuel. The length of the runway does not allow more than a day's worth of fuel to be delivered at a time, increasing the already high cost of fuel delivery by air (23).	**Opportunities:** The community has identified the need for runway improvements to accommodate larger aircraft, including upgrading to Instrument Flight Rules (IFR). The runway project has been on and off the Borough's capital improvement plan list during the last several years but improvements have not been funded **(13)**.
Resources: State: Alaska DOT&PF STIP, DCCED Designated Legislative Grants. **Federal**: Denali Commission, EDA. **Regional**: Kodiak Island Borough, SWAMC.	**Costs:** $550,000 for dock feasibility and design costs (based on Larsen Bay's proposed dock study). **Savings**: It is difficult to estimate the savings on bulk fuel transportation costs since fuel prices fluctuate daily and vendor cost data is proprietary. One study estimated savings from longer runways at $1per gallon per 100 air miles from the fuel source **(19)**.

Wind	
Medium Potential –Karluk is believed to have class 7 winds on all ridges. Wind was one of two renewable resources recommended for reducing dependence on diesel energy in Karluk in the 2010 Alaska Energy Pathway plan.	
Issue: The wind regime ranges from relatively calm winds in town to fierce and potentially damaging winds on the ridge 1,100 feet above and along the coast toward Cape Karluk. The challenge for this project may be finding a turbine that can survive the potential harsh environment of the ridge south of town, while still being sized appropriately for the electric loads. The community worked with a consulting engineer to set up a met tower on the site. The tower collapsed before data collection was complete. AEA did not receive information on why the tower collapsed. (28)	**Opportunity**: The current met tower site is up a steep ridge, 0.7 miles south of the existing powerhouse, contributing to the cost of the system. It may be possible to re-locate closer to town, where the wind model may underrepresent wind class. A feasibility study can determine best location and system for Karluk. In addition to measuring the wind resource up on the ridge, a second 10-meter tower should be installed closer to town to validate or modify the wind resource model at that location. A class 4 or 5 wind resource next to town could be easier and cheaper to develop.
Issue: A wind project will be challenged by small diesel electric loads. Winter minimum loads are in the 15-20 kW range. Adding a significant amount of wind power will reduce diesel performance and fuel efficiency to low levels.	**Opportunity**: A battery storage system is recommended to integrate wind into a diesel system with a very small load. Statewide there is also interest in using wind output for heating, which is more tolerant of power swings and easier to store. Wind to heat also has challenging economics so feasibility work is needed.
Issue: Karluk's Katolite gensets are not modifiable for electronic fuel injection, which is needed for wind integration.	**Opportunity**: If the community decides to move forward with a wind project after completing feasibility work, a new diesel generator should be chosen based on the results of the wind resource study and analysis of the hourly electrical load data.

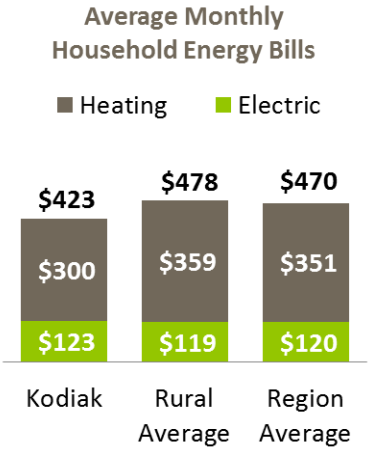
Issue: Karluk submitted an RE Fund grant application in both Rounds 6 and 7 to fund feasibility, final design and permitting of a wind energy system with heat recovery. Partial funding (feasibility only) was recommended by AEA in Round 6, but the project did not make the cut for legislative appropriation. The Round 7 application did not address the comments made by reviewers in the previous round. Karluk has problems with PCE reporting in the past which are now being addressed. AEA will not fund a village that is unable to do PCE reporting.	**Opportunity**: Any new grant application needs to address feedback from earlier reviews. AEA will want to see the results of a wind resource feasibility study, including electric/head load analysis, before allocating funds for system design. Karluk is encouraged to work directly with AEA staff before preparing a grant application. Karluk has made progress working on PCE reporting issues. Continuing to improve administration and taking advantage of utility management training opportunities will improve chances of receiving funding in future grant rounds.
Resources: **State**: AEA Anemometer Loan Program, Renewable Energy Fund, Power Project Loans, Community Development Block Grants. **Federal**: Economic Development Administration grants, USDA Rural Development grants, Indian Development Block Grants. **Private**: Partnering with a for-profit entity to take advantage of new market tax credits.	**Costs: Feasibility study:** $70,000.

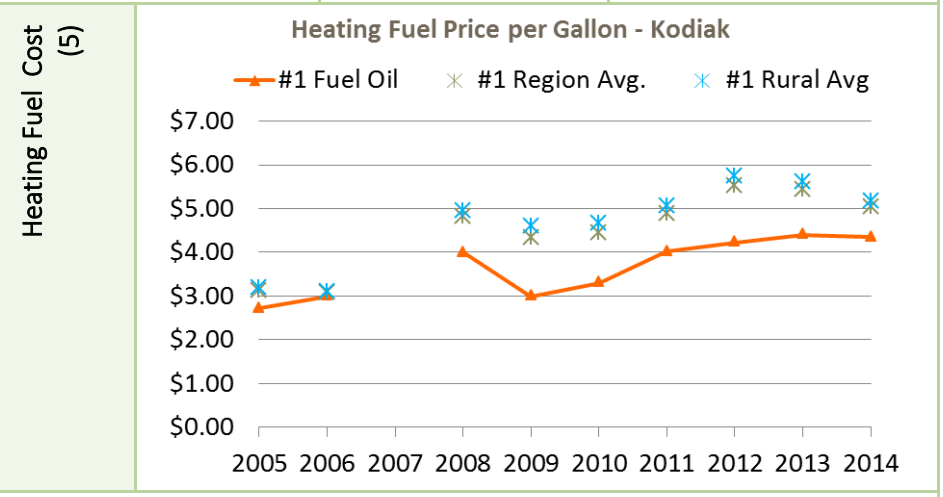
Community and Regional Plans		
Year	Report Title (Author)	Energy-related Recommendations for Karluk
2013 Update to 1984 plan	Native Village of Karluk Community Comprehensive Development Plan 2013-2018 (Rural Alaska First)	1. More affordable, energy-efficient housing. 2. Upgrade and repair water & sewer system. 3. Relocate landfill and new incinerator 4. Build a multi-use community center, reducing heating costs. 5. Build community greenhouses 6. Replace old generators to provide efficient electrical generation and train residents In maintenance. 7. Explore alternative energy options to reduce electricity costs. 8. Expand gravel airstrip to allow larger planes and reduce cost of flying in fuel and other transportation costs.
2013	Kodiak Rural Regional Comprehensive Economic Development Strategy (Kodiak Area Native Association)	1. Airstrip expansion, including IFR equipment, to accommodate larger planes 2. Alaska Marine Highway service would open up community for tourism and reduce transportation costs for goods and passengers. 3. A boat harbor would allow goods to be transported at less expense and allow local residents involved in fishing to moor boats in home port.
2009	Kodiak Island Borough Regional Energy Plan (Kodiak Island Borough Community Development Department)	1. EE conservation education. Install energy saving bulbs, power strips, and appliances in all homes. Recycle light bulbs. Use T-8s in City offices, LED Christmas lights. Weatherize homes. 2. Wind: Install wind-metering tower. 3. Study hydro potential. 4. Diesel Efficiency: Recapture heat from existing generators such as school and water plant. 5. Study tidal potential. 6. Consistent, ongoing training required.
2008	Kodiak Island Borough Comprehensive Plan Update (Kodiak Island Borough)	1. Explore feasibility of Karluk- Larsen Bay road. 2. Develop additional transportation options or facilities (e.g. barge service, air strip improvements). 3. Improve condition of HUD housing
2003 Update to 2001	Kodiak Region Comprehensive Economic Development Strategy - Revised (Kodiak Chamber of Commerce)	1. Permanent dock facility
1980	Regional Inventory and Reconnaissance Study for Small Hydropower Projects (ACOE, Alaska District)	Three unnamed lowhead sites analyzed with annual stream flows ranging from 4.1 to 15.4 cfs; net heads from 240 to 405 ft.; and potential capacity from 180 to 420kW. Note: Salmon migration in all streams with hydropower potential.

KODIAK

KEA Vision	"KEA shall endeavor to produce 95% of energy sales with cost effective renewable power solutions by the year 2020." KEA will continue to strive for that even beyond 2020.	
Kodiak and KEA Energy Priorities[1]	Priorities	Concerns
	Focus on energy conservation internally and externally to manage demand	- Weatherization and efficiency action - Locating qualified contractors to do efficiency improvements - Education
	Future hydroelectric expansion at Upper Hidden Basin	
	Add more wind or other renewables to meet future load demand	
Local and Regional Stakeholders Groups	Kodiak Island Borough	
	City of Kodiak	
	Kodiak Electric Association	
	City of Port Lions, Communities of Chiniak, Kodiak Station, Pasagshak, Womens Bay	
	Kodiak Island Borough School District	
	U.S. Coast Guard	
	Koniag, Inc.	
	Kodiak Island Housing Authority	
	Kodiak Area Native Association	
	Seafood Processors	
	Kodiak Chamber	
	Southwest Alaska Municipal Conference	
	U.S. Fish & Wildlife Service	
Sources: **(29) (13)**. **Notes**: 1/ Based on Phase II input.		

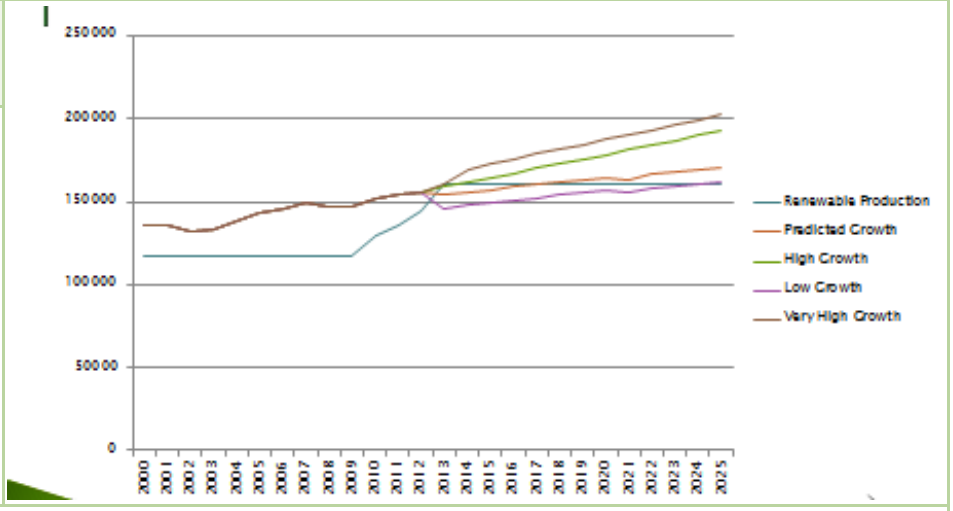
TOTAL ENERGY USE			
Electrical Generation [1,2] (KEA Grid)	**Diesel**: 7,051MWh **Renewable**: 147,261 MWh	**Sold**[2]: 89,279 MWh	
Community Load	**Average** 17.6 MW **Peak**: 27.8 MW	**Electric Customers**	**Residential**: 2,726 **Commercial Non-governmental:** 557 **Governmental:** 94
Annual Fuel Use	**Electric**: 490,000 gals. (2013) 70,000 gals. (2014 projected)	**Space Heating**: Not Known	**Transportation**: Not Known
Fuel Price	**Electric**: $3.50/gal	**Heating**: $4.35/gal #1 Oil (Jan. 2014) (5)	**Transportation**: Not Known



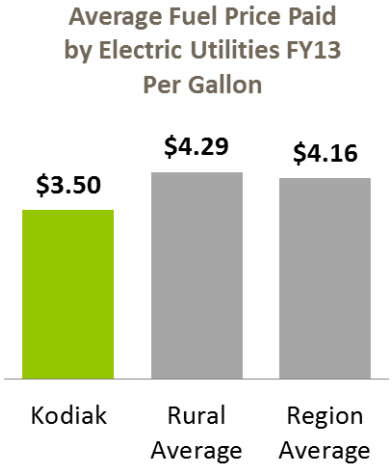


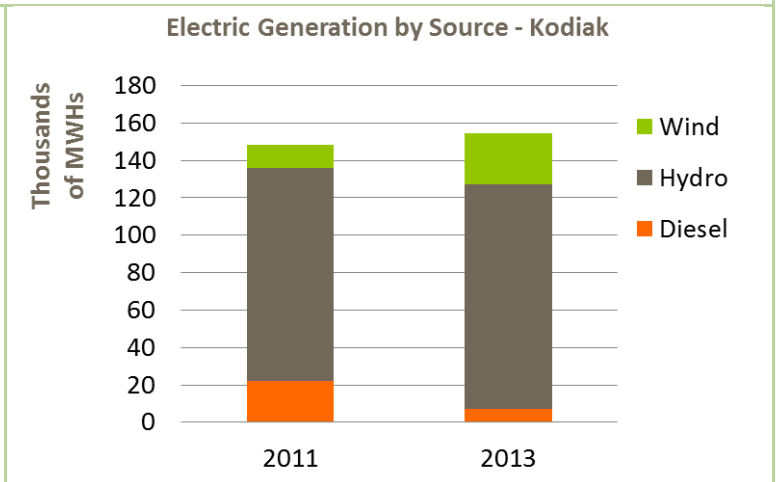
Projected Load Growth (30)

Peak load for the KEA grid continues to grow. KEA hit a new peak of 27.8 MW in early 2013. KEA projects the electric load to grow slowly, continuing past trends.



Sources (except as noted): **(31)**. **Notes**: 1/ KEA grid includes Kodiak Roadbelt communities and Port Lions.
2/ Amount sold reflects City of Kodiak only. It does not include the U.S. Coast Guard Base, which is a large electric customer, using approximately 20,396 MWh in FY 2013 **(32)**.

<table>
<tr><th colspan="4">ELECTRIC GENERATION</th></tr>
<tr><td>Utility</td><td colspan="3">Kodiak Electric Association</td></tr>
<tr><td>PCE</td><td>Ineligible</td><td>RPSU Upgrade</td><td>Ineligible</td></tr>
<tr><td>Diesel Capacity (30)</td><td>Kodiak Generating Station: 17.6 MW
Nyman Power Plant: 9 MW
Swampy Acres: 3.6 MW
Port Lions Power Plant: 0.76 MW</td><td>Renewable Capacity</td><td>40 MW</td></tr>
<tr><td>Residential Rate</td><td>Residential: $0.138/kWh</td><td>Cost per kWh Sold[1] (33)</td><td>Diesel: $0.29
Wind: $0.11
Hydro: $0.07</td></tr>
<tr><td>Load Forecast</td><td colspan="3">KEA expects the electric load to continue to grow slowly due to the increasing use of electricity for heat with the use of heat pumps and on-demand water heaters. KEA expects current hydro and wind capacity to handle peak load through 2025. KEA plans to bring additional hydro capacity online in the next 5+ years to meet power needs well past 2025 (34).</td></tr>
<tr><td>Electrical Generation and Fuel Cost (31) (5)</td><td colspan="3"> 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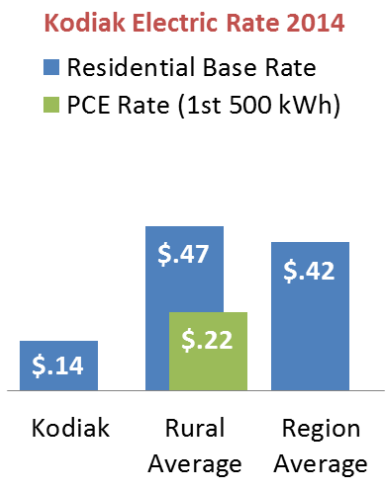
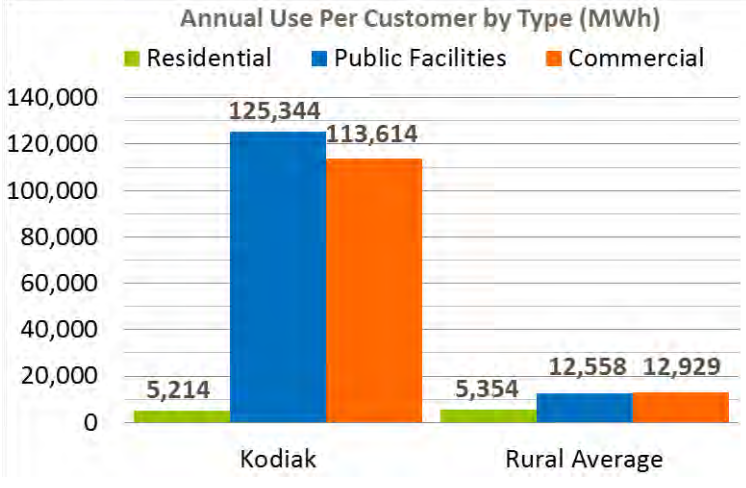
<tr><td>Electric Rate and Use by Customer Type</td><td colspan="3"> 


</td></tr>
<tr><td colspan="4">Sources (except as noted): (5). Notes: 1/ Generation cost only.</td></tr>
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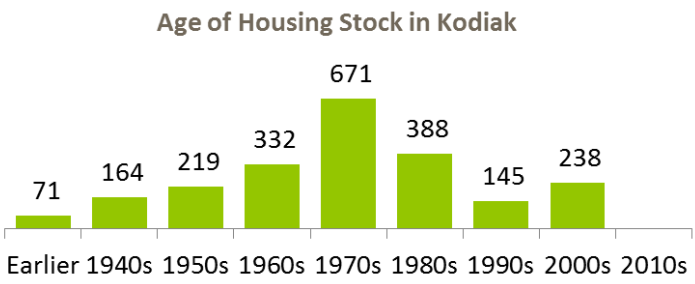
ENERGY EFFICIENCY AND CONSERVATION

Residential

Occupied Housing Units	**Housing Type, including Vacant**	Average Home Size (est.)[1]	**Avg. HH Size / Overcrowding**	Median HH Income	Energy Cost as a % of Income
2,723	1,124 Single Family 303 Duplexes 762 Multi-Family 39 Mobile Homes	1,701	3.1/ No	$58,670	11%

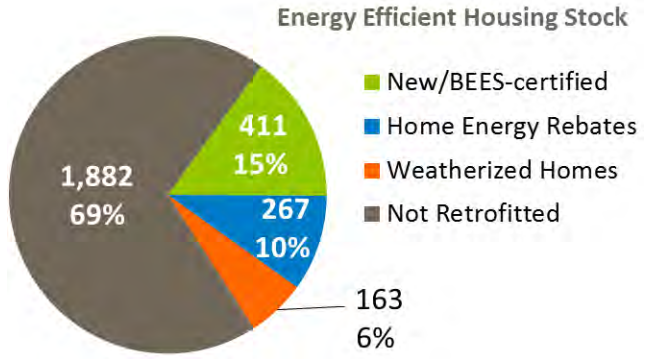


Estimate Annual Energy Use per Home[1]	**Average Annual Home Energy Bill**
185 MMBTU	$6,348

Note: Older homes are typically less energy-efficient than newer homes, due to improvements in building technology and energy efficiency over time.

Annual Home Energy Savings Achieved	Additional Annual Home Energy Savings Opportunity	**Percent of Residential EE&C Work Remaining**
23,411 MMBTU 168,093 gals. $731,206	58,371 MMBTU 419,107 gals. $1,823,117	69%

Assumptions: Average energy savings for region based on 2008-13 ARIS data (35% HER, 18% AHFC weatherization projects). Retail fuel cost: $4.35/gal.



Non-residential Public Buildings

Kodiak Island Borough: EE&C measures have been taken in City of Kodiak in the design and construction of new buildings: new waste water treatment plant built in 2012, all building energy needs (including heat) met with electricity; new pump house at Monashka uses variable frequency drive and heat recovered from cooling system (35)**.** KEA is replacing all street lights in the city in stages with LED lights. Much of public building stock dates from 1970s and 80s and provides opportunity for significant additional savings.

Kodiak Island Borough School District: Energy audits were conducted on 4 KIBSD schools in communities on the KEA grid in 2012 (see Appendix B). KIBSD is in the process of making the most cost-effective recommended improvements, especially as repair and replacement needs arise. (36) (37)

U.S. Coast Guard Kodiak Base: With over 400 buildings and 600 housing units, Kodiak Base is the largest Coast Guard station in the world. A major user of electricity and fuel on Kodiak Island, the base took the lead in a pilot program under the Regional Super Energy Saving Performance Contract to identify areas of energy savings and design retrofits to upgrade inefficient equipment and infrastructure. (See appendix B.) A new housing project on base will be completed in 2015 and the units will have all energy needs met with electricity. The precise technology to be used has not yet been decided. Additional lighting upgrades will occur as buildings are scheduled for maintenance and all new projects are focused on being LEED certified (38) (32).

Kodiak College: Completed EE&C projects include re-insulating roofs, continual lighting upgrades to T8s and LEDs and parking lot lights automatic shutoff at night, installation of occupancy sensors in different locations,

ENERGY EFFICIENCY AND CONSERVATION					
automated building control system, and installation of variable frequency drives to lower energy usage from fans, hot water pumps, etc. (39).					
Other Community Infrastructure					
Water & Sewer System Type / No. of Homes Served	**Water and Sewer Rates**	Estimated Annual Water & Sewer (W&S) Energy Use[2]	**Sanitation System Energy Audit Performed**	**Estimated Cost of Water & Sewer EE&C Upgrades**	**Estimated Annual Water & Sewer Energy Savings[3]**
Unknown	Unknown	6,879 MMBTU 23,076 gals. 1,074,934 kWh	Unknown	Unknown	688 MMBTU 2,308 gals. 107,493 kWh
Sources: (10) (40). **Notes**: 1/ Average for Koniag Region in the ARIS database. 2/ Reported energy and fuel usage for City of Kodiak; estimated electrical use (11). 3/ Assumes 10% energy savings for electricity and heat.					

Bulk Fuel Purchase			
Entity	#1 Fuel Oil (gals.)	#2 Fuel Oil (gals.)	Total (gals.)
KEA	70,000	-	**70,000**
KIB[1]	14,300	95,800	**110,100**
KIBSD[1]	19,200	267,500	**286,700**
Providence Hospital Kodiak[1]	300	120,000	**120,300**
U.S. Coast Guard Base	4,468	487,263	**491,731**
Sources (except as noted) **(41) (36)**. **Notes**: 1/ 2014 Bulk Fuel Purchase amounts.			

ENERGY PLANNING

BIOMASS

Moderate Potential – With 11 land-based fish processors and one class 1 landfill, the City of Kodiak also has potential for future biomass projects fueled by fish or solid waste. It does not appear to have sufficient woody biomass to meet the needs of a large-scale heat or power project, according to an initial assessment by the National Renewable Energy Laboratory (NREL) and one by Alaska state foresters. There may be sufficient localized resources to support smaller-scale projects in specific communities.

Issue: Sitka spruce is most abundant on the Northeastern shores of Kodiak Island especially around Monashka Bay and Chiniak. By contrast, the Womens Bay and Pasagshak areas are characterized by wetland vegetation, grasses and alder shrubland with only scattered patches of spruce (13).	**Opportunity**: If there are local communities interested in considering a wood biomass project, a reconnaissance study can be done to determine whether sufficient biomass exists nearby to sustain a modestly scaled biomass project, such as a GARN boiler, to heat one or more community buildings.
Issue: In Alaska, biodiesel is primarily manufactured from fishmeal processors, not those who produce whole fish, fillets or canned salmon. Most is used onsite by processors themselves or may be exported as animal feed supplements or for other uses. To make biodiesel manufacture attractive, diesel prices must be high enough to offset capital costs for equipment to extract oil from fish waste. If not processed immediately, fish waste degrades rapidly and quickly loses its value. Currently, a lot of fish waste is ground up and dumped into the ocean where it can disrupt marine ecosystems.	**Opportunity**: There have been demonstration projects in Alaska and globally on making biodiesel from fish waste. Biodiesel can be blended with #2 diesel or used directly in generators, other engines, boilers and fishmeal dryers. With 11 land-based processors who need an environmentally sound way to dispose of fish waste, Kodiak is well suited to study the feasibility of a system to collect, transport and store fish waste for processing into biodiesel on an economic scale. Possible partners include AEA, the University of Alaska, EPA and fish processors.

Issue: With an abundance of clean energy alternatives, KEA has no current plans for a utility-scale municipal solid waste (MSW) project. Considerations include emissions, cost of separating waste, and benefits of extending landfill life.	**Opportunity:** With a class 1 landfill, Kodiak likely has enough municipal solid waste for a large-scale heating project, though perhaps not enough for combined heat and power using steam to produce electricity or for biogas production from methane. As energy prices, technology and landfill size changes in future a pre-feasibility study may be desired to assess options.
Resources: UAF: Alaska Wood Energy Development Task Group (pre-feasibility studies). **AEA**: Biomass Program (technical assistance), Renewable Energy Fund (grants). **USDA-RD**: Rural Energy for America Program (small business or agricultural producers)	**Costs and savings**: Fish and solid waste systems: unknown. Woody biomass: No cost to community for pre-feasibility study through AWEDTG grant. System cost: $100,000 minimum. Annual O&M: $500 plus 1 hour labor per day **(15)**. Savings depend on size of system and local cost of wood. $250 to $300 per cord provides the same amount of heat as fuel oil at $3.50 per gallon.

EMERGING TECHNOLOGIES	
Unknown – Initial reconnaissance models suggest that Whale Passage near Port Lions may have the best tidal energy resource in the region.	
Issue: Tidal energy like other ocean power technologies is not yet close to ready for commercial deployment. There are competing devices being tested and ongoing demonstration projects in Alaska and elsewhere. Since these technologies are still in R&D, a watch and wait approach is advisable.	**Opportunity:** KEA is monitoring technology and ongoing research on tidal energy. Whale Passage is not far from a KEA distribution line so should the technology and resource be proven, a significant opportunity exists for adding new renewable capacity to the KEA grid.
Resources: Emerging Energy Technology Fund	**Cost:** No cost for monitoring developments.

ENERGY EFFICIENCY AND CONSERVATION
High Potential – As in other communities in the region, the cheapest kilowatt or gallon of fuel is the one you don't have to buy. The City of Kodiak has completed the most EE&C work in the region but there is still high potential to save on energy costs by actively promoting additional residential and commercial EE&C and by auditing public buildings and facilities (street lights and water/sewer system) to identify potential savings.
Home Energy Rebates and Weatherization: Over 80% of the city's housing stock was built before 1980 when energy ratings of 2 or 2-star-plus were typical, and have energy costs that are 40% to 50% higher than a 4-star-plus or 5-star home built since 2000. The majority of these homes in the city have not been weatherized with AHFC funds. Only 267 homes in Kodiak have participated in AHFC's Home Energy Rebate (HER) program, which provides higher energy savings (35%) per home compared with weatherization programs in the region (18% savings) and has no income limits, but requires the house to be owner occupied. (Homes previously weatherized through AHFC are not eligible for the HER program.) A community can increase HER participation rates by actively promoting the program and encouraging residents to sign up or helping them to do so. Residents could save 58,371 MMBTU community-wide if all homes not already audited or weatherized are retrofitted. Annual fuel savings would be 419,107 gallons and $1,823,117 in avoided fuel cost each year.

ENERGY EFFICIENCY AND CONSERVATION

Public Facilities and Commercial Buildings: Over 71% of electricity is used by non-governmental commercial buildings and another 13% by public facilities. Only 16% is used by private residences. Kodiak should focus on the public and commercial sectors in encouraging EE&C behaviors and audits. Building owners can expect 10-15% annual savings from EE&C improvements by making only behavioral changes, 15-25% savings if making all the most cost-effective changes, and 25-35% savings if all recommended energy improvements are completed. To achieve a 30% savings, the typical investment is estimated at $6 to 7 per square foot.

Street Light Upgrades: LED street lighting is highly efficient compared to conventional street lights. Though somewhat capital intensive, it can save up to 75% on energy usage on public outdoor lighting. KEA has taken the lead in replacing street lights in the city of Kodiak and is also encouraging residents to replace lights with LEDs. The utility has a 10 year vision of changing out all street lights.

Water and Sewer Facilities: Sanitation systems are huge users of energy, accounting for 10% to 38% of community energy use, depending on system type and climate zone. Together the sewage lift and pump stations and waste water treatment plant for the City of Kodiak use 3,630 MWh of electricity per year (see Appendix B). An energy audit and upgrade of facility could save the city substantial amount on electrical costs.

Electric Heating: Residents have already begun installing equipment hot water heaters and air source heat pumps that use electricity rather than oil for heating. Heat pumps are highly efficient (over 100%) so this move away from heating oil is also a move toward greater energy efficiency. KEA is looking at the option of offering loan packages to customers wishing to switch to air source heat pumps **(29)**.

Resources: **State**: AFHC Home Energy Rebate, Weatherization, and Roving Energy Rater programs. AEA CBEA (commercial enterprises), Alaska DEED Capital Improvements Program (schools). Alaska DCCED Alternative Energy and Conservation Revolving Loan Fund (public and commercial facilities). AHFC Alaska Energy Efficiency Revolving Loan Program (public facilities). **Federal**: U.S. HUD NAHASDA Grants through KIHA, USDA RD Rural Energy for America Guaranteed Loan Program (small business), Federal Tax Deduction for Commercial Buildings. DOE-IE START Alaska, other Tribal energy programs. **Regional**: EE&C Coordination through KANA (pending successful EDA grant application) or other entity.

FOSSIL FUELS

Low Potential – Coal, oil and gas are not known to occur in large quantities in the Kodiak region. Coal beds on Kodiak Island are believed to be thin and likely not an economic resource. The geology also makes it unlikely that commercial quantities of conventional or unconventional oil and gas resources will be discovered. **(16)**

GEOTHERMAL

Medium Potential – There are no known geothermal resources in Kodiak region **(16)**. However, air source heat pumps are already being installed in the City of Kodiak to take advantage of relatively low electricity rates and to avoid high heating costs. There is potential for ground source heat pumps in the City of Kodiak as well **(42)**. KEA expects the use of heat pumps to continue, which will increase the electric load on the KEA grid.

Issue: Ground source heat pumps (GSHP) have high capital costs and are typically economic only where fuel costs are high and electric rates low. Air source heat pumps (ASHP) have much lower capital costs but because they also require electricity to operate, they may still be uneconomic if electrical costs are high or volatile.	**Opportunity:** With a relatively moderate climate, stable electricity rates and high heating oil costs communities on the KEA grid can consider ground and air source heat pumps. Using air-to-air heat pumps with in-floor heat in Kodiak is currently equivalent to heating with fuel oil at $2.50 per gallon **(41)**. If increased heat pump use becomes a priority, KEA could consider incentives offered by utilities in Southeast Alaska to encourage users to install them.

Resources: State: Research on heat pump design and costs is ongoing at UAF's Alaska Center for Energy and Power (ACEP). The Cold Climate Housing Research Center, also at UAF, is conducting research and demonstration projects on both types of heat pumps.	Air Source Heat Pumps: **Capital cost**: $6,000. **Savings**: $600 to $2,700 annually, based on model for 3 bedroom home in Kodiak **(43)**. Ground Source Heat Pumps: **Capital cost:** $29,300. **Savings:** $1,600 to $2,900 annually based on a 1,700 sf home in Juneau with lower electricity and fuel costs than Kodiak **(44)**.

HYDROELECTRIC

High Potential —The Terror Lake hydro facility generated over three-quarters of the electricity for the KEA grid last year. In 2014 its share of total generation has climbed to 84% following installation of a third 11 MW turbine. With the addition of this unit, Terror Lake's capacity is approximately 32 MW, which should be enough to handle the peak loads until well after 2025. KEA plans to continue to increase hydro capacity to meet future demand. The utility is currently studying the feasibility of a hydro site at Upper Hidden Basin and plans to submit a FERC permit request in the next year. Development will take another 4 to 5 years. **(33) (34)**

Opportunity: Hydropower is reliable, cost effective and dispatchable (meaning you can call on it when you need it versus other forms like wind and tidal which are not always available.) This is very important for an islanded electric grid. Since hydroelectric power is dispatchable and KEA has pushed its variable power resources incredibly far, expanding hydro further will increase the stability of the grid and make possible future expansion of variable energy resources..

SOLAR

Low Potential – Solar does not offer a utility-scale solution in the region, but solar PV and solar thermal projects can provide relief for individual homes and facilities, especially those off the grid or that have high summer electric usage

Issue: Kodiak receives an average of 3 kWh/m^2/day of solar radiation annually, with most coming in April to August. A 4 kW fixed-tilt solar PV array on a building in Kodiak can produce 3,373 kWh of AC power per year if the solar panels are kept free of snow. PVWatts estimates the cost of producing solar energy at $0.38/ kWh. This does not make economic sense if connected to the KEA grid given the $0.19/ kWh cost of electricity where nearly 100% of electricity is generated using renewable sources (1)**.**	**Opportunity**: Using solar technologies to reduce space and hot water heating costs may be more economical than using solar energy to generate electricity. However, these systems are significantly more complex to set up and maintain than PV arrays and so having trained and knowledgeable operators is important.

NREL: PVWatts Viewer (calculates potential solar energy production and cost), funding, technical support**.**	**Costs:** Capital costs: $3 to $10 per watt depending on who does the installation, making the installed cost of a 4kW system $12,000 to $40,000. Costs for a system off the grid need to include the cost of battery storage. **Savings**: Not known.

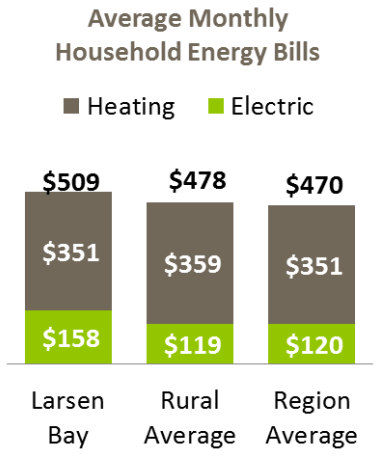
Wind
High Potential –KEA has a 9 MW wind farm on Pillar Mountain that generated 18% of the electricity for the grid in 2013 **(33)**. KEA is a world leader in variable power integration on an islanded grid. At this time, the utility's wind penetration rate can reach up to 80%. It has a 3 MW Battery Energy Storage System (BESS) that allows the grid to stay stable with that much wind, but until the electric load grows substantially, KEA will not be able to consider large amounts of new wind power. **(34)**

Community and Regional Plans		
Year	**Report Title (Author)**	**Community-specific, Energy-related Recommendations**
2009	Kodiak Island Borough Regional Energy Plan (Kodiak Island Borough Community Development Department)	1. KEA has planned and obtained grants and provided funding for a major wind turbine project located on the ridge line of Pillar Mountain, overlooking the City of Kodiak. 2. KEA has approval for another three wind turbines should the demand and financial feasibility coincide. It may be too early to say for certain as the wind turbines have only been in operation less than six months. 3. Study the potential to increase power production of existing hydro-electric facilities by increasing reservoir capacities, upgrading turbines and control mechanisms, and by increasing the number of turbines where feasible.
2008	Kodiak Island Borough Comprehensive Plan Update (Kodiak Island Borough)	1. KEA studying a wind energy site on Pillar Mountain. 2. Studies being conducted to analyze the feasibility of wind generated power, as are site considerations for additional hydroelectric power generation. A site on Pillar Mountain has been proposed for wind generated electricity. 3. Explore opportunities for new hydroelectric, tidal, or wind power facilities in local communities throughout the Borough; utilize case studies and best practices from similar projects in other communities. 4. Help provide energy in a cost-effective, energy-efficient manner, in part to address the effects of high costs of fuel. 5. Work with local communities and residents to support development of alternative, less-costly fuel or energy sources. 6. Explore the feasibility of providing subsidies to low income households to assist in paying for the cost of heating and/or electricity bills.
2003 Update to 2001	Kodiak Region Comprehensive Economic Development Strategy - Revised (Kodiak Chamber of Commerce)	1. Study opportunities to reduce electrical rates through diversified power supplies. 2. Study opportunities to lower electrical costs through increased conservation strategies. 3. Research alternative sources of power.
2001	Kodiak Region Comprehensive Economic Development Strategy - Revised (Kodiak Chamber of Commerce)	1. Evaluate available options to achieve maximum utilization of electrical power, and to overcome or offset the cost of power in Kodiak. 2. Study opportunities to reduce electrical rates through diversified power supplies. 3. Study opportunities to lower electrical costs through increased conservation strategies. 3. Research alternative sources of power. 4. Monashka Dam Phase II, design phase.

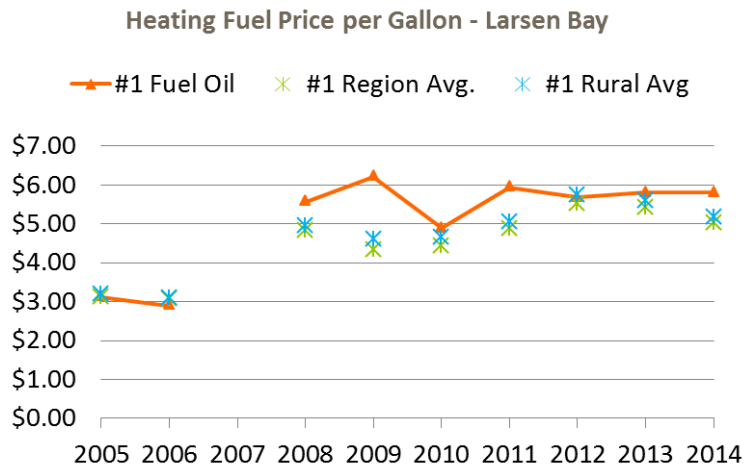
LARSEN BAY

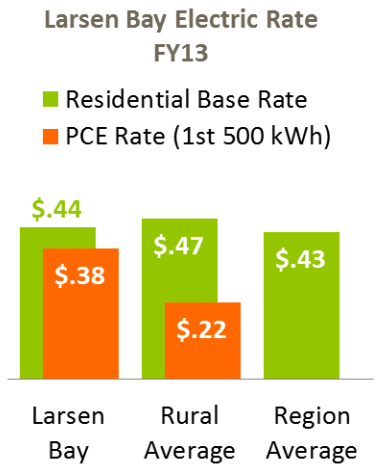
Community Vision	Community togetherness and spirit, education, environment, sustainable economy, and community control.		
Community Energy Priorities[1]	Priorities	Concerns	
	Plan for dam upgrade and reservoir expansion	Beavers affecting hydro dam	
	Expand hydro to heat to city, clinic buildings		
	Work with AEA to set up MET towers; study integration with diesel and hydro system		
Local Stakeholders Groups	City of Larsen Bay	Larsen Bay Tribal Council	
	Larsen Bay Utility	Icicle Seafoods	Larsen Bay Lodge
Energy Champions[1]	Power plant operators: Sam Kenoyer, Hugh Kennan		
Sources: **(20) (2) (45)**. **Notes**: 1/ Based on Phase II input.			

TOTAL ENERGY USE			
Electrical Generation	**Diesel**: 23 MWh **Renewable**: 807 MWh	**Sold**: 748 MWh	**Line Loss**: 7.4% **Powerhouse**: 2.5%
Community Load	**Average**: 69 kW **Peak**: 153 kW (4)	**Electric Customers**	**Residential**: 52 **Community Facilities**: 8 **Other (Non-PCE)**: 41
Annual Fuel Use	**Electric**: 2,245 gals.	**Space Heating**: 43,771 gals. (4)	**Transportation**: 30,000 gals. (22)
Fuel Price	**Electric**: $4.45/gal. (FY2013)	**Heating**: $5.81/gal. #1 Oil (Jan. 2014) (5)	**Transportation**: $6.50 (Jan 2014) (46)

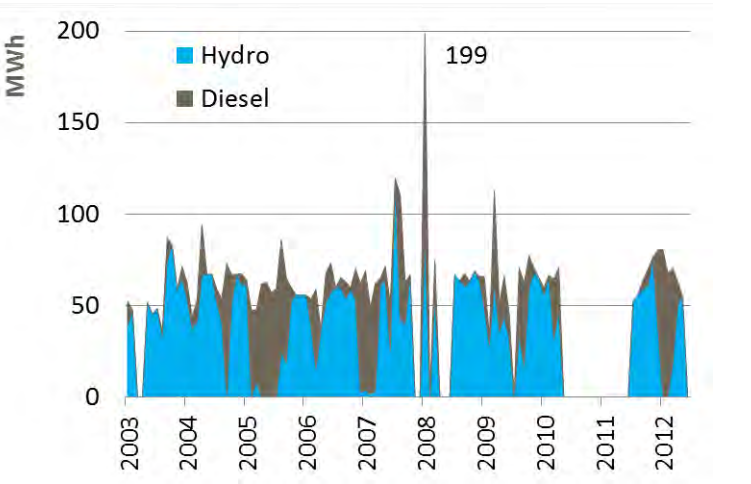


Heating Fuel Cost (5)

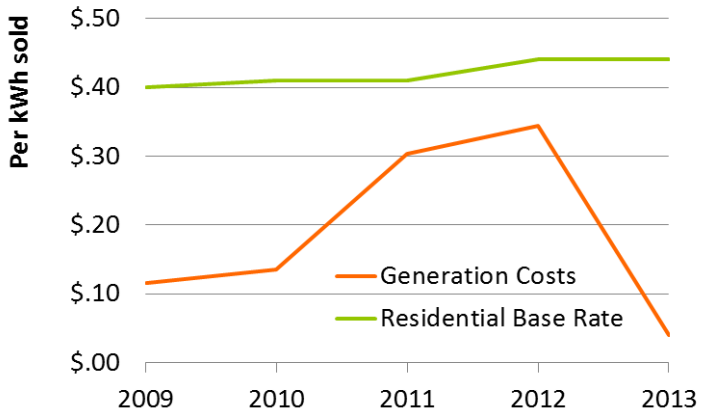
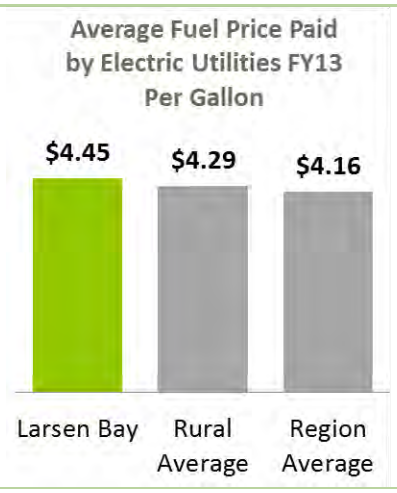
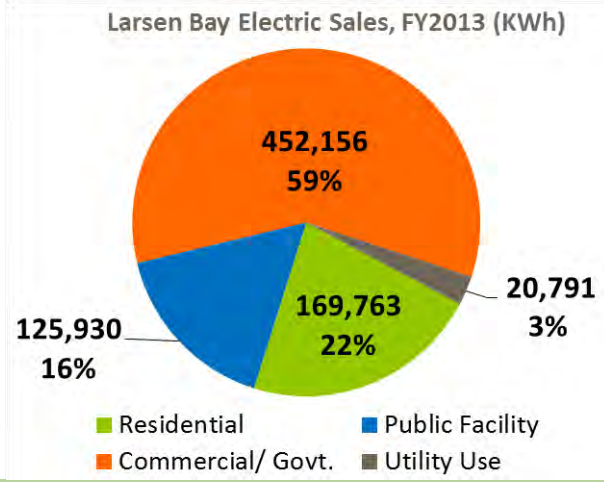
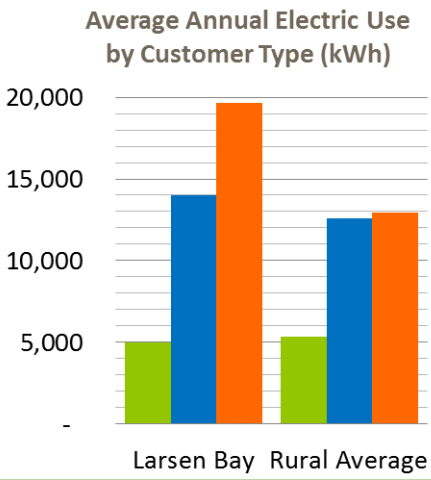




Electrical Generation (5)



Sources (except as noted): **(7)**

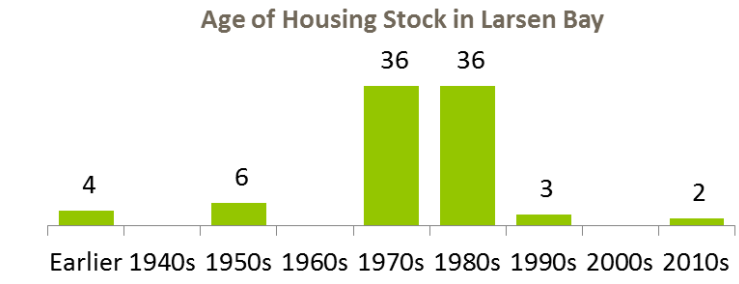
ELECTRIC GENERATION			
Utility	Larsen Bay Utility Company		
PCE (level)	Active ($0.06/kWh)	RPSU Upgrade	Completed
Diesel Capacity	1 x 210 KW, 2 x 65 KW	Renewable Capacity	475 kW
Diesel Generators	NA. 3 new generators and new powerhouse building in 2014. All will act as backup to hydro.	Load Sizing	Oversized for load
		Load Imbalance	10-25% Imbalance
Diesel Efficiency[1]	10.1 kWh/gal. (based on previous generators)	Switchgear	NA
Residential Rate	**Effective**: $0.38 (1st 500 kWh) **Base**: $0.44	Cost per kWh Sold[2]	**Fuel**: $0.01; **Non-Fuel**: $0.02 **Total**: $0.04
Operator Proficiency	**Good:** Logs. **Acceptable:** Meter reading. **Unacceptable:** Maintenance planning, routine and scheduled maintenance	Heat Recovery	None
Generation Costs [2]			
Electric Sales by Customer Type			

Sources (except as noted): **(7) (8)**. **Notes**: 1/ Diesel efficiency is based on generators installed during FY2013, which were in fair or poor condition. Efficiency should improve with new generators to be delivered in 2014.
2/ Generation cost numbers reported for FY2013 to the PCE program are very low and should be confirmed.

ENERGY EFFICIENCY AND CONSERVATION

Residential

Occupied Housing Units	Housing Type, including Vacant	Average Home Size (est.)[1]	Avg. HH Size / Overcrowding	Median HH Income	Energy Cost as a % of Income
34	82 single family 5 mobile homes	1,056 sf	2.2/ No	$71,000	9%

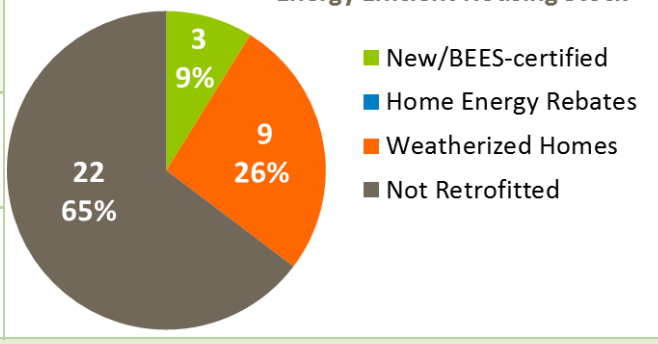


Estimate Annual Energy Use per Home	Average Annual Home Energy Bill
117 MMBTU	$6,111

Note: Older homes are typically less energy-efficient than newer homes, due to improvements in building technology and energy efficiency over time.

Annual Home Energy Savings Achieved	Additional Energy Savings Opportunity	**% of Home EE&C Work Remaining**
194 MMBTU 1,395 gals. $8,105	516 MMBTU 3,703 gals. $21,517	65%

Assumptions: Average energy savings for region based on 2008-13 ARIS data (35% HER, 18% AHFC weatherization projects). Retail fuel cost: $5.81/gal.



Public and Commercial Buildings

No. of Public/ Commercial Buildings[2]	Types of Buildings	Est. Annual Energy Use per Building[3]	Public or Commercial Building Audits	EE&C Measures Identified	EE&C Measures Implemented
49	See Appendix B	1,178 MMBTU	School	See Appendix B	In Progress
Street Light Number	**Street Lighting Type**	**LED Street Lighting Upgrade**	**Street Lighting Remaining Opportunity**	**Estimated Cost of LED Street Light Retrofit[4]**	**LED Street Lighting Annual Energy Savings[4]**
Not Known	Not Known	No	100%	$1,000 per light or $5,000 to $18,000 total	4,800 to 7,500 kWh / $1,400 to $2,200
Water & Sewer System Type / No. of Homes Served	**Water and Sewer Rates**	**Estimated Annual Water & Sewer Energy Use[1]**	**Sanitation System Energy Audit Performed**	**Estimated Cost of Water & Sewer EE&C Upgrades**	**Estimated Annual Water & Sewer Energy Savings[5]**
Water: Pressure Sewer: Gravity 40 Homes	Not Known	350 MMBTU 2,090 gals. 17,152 kWh	No	Not Known	35 MMBTU 379 gals./ 1,715 kWh / $2,201

Sources: (9) (10). **Notes**: 1/ Calculated based on Energy End-Use Study data (11). 2/ Based on number of electric rate payers. 3/ Calculated based on Energy End-Use Study and 2013 Alaska Housing Assessment data (11) (12). 4/ Based on ARIS data for communities of 50 to 100 people. 5/ Assumes 10% savings on fuel and electric.

DIESEL EFFICIENCY AND HEAT RECOVERY					
Annual Savings from a Diesel Efficiency of 13.0 kWh/gal.[1]	Heat Recovery Installed at Power Plant	Buildings Heated with Waste Heat	Additional Heat Recovery Opportunity	Estimated Cost of Water Jacket Heat Recovery	Est. Annual Savings from Water Jacket Heat Recovery
501 gals. $2,229	No	0	School, Community Building	Capital cost: $200,000 and up	534 MMBTU[2] or 10 to 20%

BULK FUEL			
Capacity	**City:** #1 Oil: 10,000 gals; #2 Oil: 76,500 gals; Gasoline: 41,500 gals. (47); **School**: 5,000 gals. **Cannery**: NA	Fuel Purchase (22)	Larsen Bay participates in the Bulk Fuel Revolving Loan Program. 2014 order: **#1 Oil:** 10,000 gals. **#2 Oil:** 15,000 gals. **Unleaded**: 30,000 gals.
Bulk Fuel Upgrade	Completed 2004	Vendors	
By Barge	Fuel is delivered to the tank farm by barge. The barge has to anchor out due to lack of a dock which increases fuel costs. There are two 4-inch marine receiving pipelines, which extend from the primary marine headers to the tank farm. Alternate marine headers are adjacent to the small boat harbor. The City Is putting in a $550,000 request for design of a new dock. **(47)**		
Local Delivery	City retails gasoline and #2 diesel from dispensing station adjacent to tank farm bulk transfer area. It conducts bulk transfers of # 1 and #2 diesel for local delivery; and retails #2 diesel to small vessels at the City dock. The City delivers fuel to the school tank monthly. **(47) (45)**		
Cooperative Purchase	The City and cannery sometimes work together on fuel purchases. The cannery has its own fuel tanks.		
Sources (except as noted): (45). **Notes:** 1/ Based on FY2014 PCE data (7). 2/ 2010 Alaska Energy Pathway estimate has not been updated or verified (4).			

ENERGY PLANNING

BIOMASS	
Medium Potential – Wood was one of the three energy pathways identified for Larsen Bay in the 2010 Alaska Energy Pathway report (the others being wind and hydro). However, the local timber resource is limited and there is no sawmill to supply wood waste. There is one fish processor in Larsen Bay with an unknown potential to provide fish oil for use as biofuel. There is no class I landfill to provide sufficient quantities of solid waste to fuel a heat or combined heat and power project.	
Issue: In Alaska, biodiesel is primarily manufactured from fishmeal processors, not those who produce whole fish, fillets or canned salmon. Most is used onsite by processors themselves or may be exported as animal feed supplements or for other uses. Currently, a lot of fish waste is ground up and dumped into the ocean where it can disrupt marine ecosystems.	**Opportunity**: Biodiesel can be blended with #2 diesel or used directly in generators, other engines, boilers and fishmeal dryers. If not processed immediately, fish waste degrades rapidly and quickly loses its value. To make biodiesel manufacture attractive, diesel prices must be high enough to offset capital costs for equipment to extract oil from fish waste.
	
Issue: There are scattered trees with some locally heavy stands, but no Sitka spruce or western hemlock. The federal government also owns significant land holdings near Larsen Bay, which are protected as part of the Kodiak National Wildlife Refuge.	**Opportunity:** A reconnaissance study is needed to assess the forest resource near the community that is not on protected lands to determine whether it can sustainably support a modestly scaled biomass project, such as a GARN boiler, that could heat one of Larsen Bay's community buildings.
Issue: Wood biomass projects have the added benefit of creating local jobs as wood cutters and boiler operators, but they require strong community leadership and interest to succeed. To date, biomass is not one of the renewable energy technologies the community has expressed interest in.	**Opportunity**: A community biomass project with strong local champions could provide both skilled and unskilled jobs, while reducing heating costs and diesel dependence. If community members are interested, there are several programs to help them explore biomass options.

Resources: State: UAF Alaska Wood Energy Development Task Group (AWEDTG) pre-feasibility studies), AEA Biomass Program (technical assistance), AEA Renewable Energy Fund (grants). **Federal**: USDA-RD Rural Energy for America Program (small business or agricultural producers).	**Costs and savings**: Fish and solid waste systems: unknown. Woody biomass: No cost to community for pre-feasibility study through AWEDTG grant. System cost: $100,000 minimum. Annual O&M: $500 plus 1 hour labor per day. **(15)** Savings depend on size of system and local cost of wood. $250 to $300 per cord provides the same amount of heat as fuel oil at $3.50 per gallon.

DIESEL EFFICIENCY AND HEAT RECOVERY

Medium Potential – In FY2013, diesel was used to generate only 3% of Larsen Bay's electricity, but there is still some opportunity for additional savings through optimizing diesel efficiency by improving maintenance and investing in operator training. There may be future potential to use excess hydro for heating.

Issue: A Rural Power System Upgrade is in progress in Larsen Bay, including new generators, automatic switchgear and new Pelton wheel, to be completed in 2014. The electrical distribution system is still in poor condition and needs major repairs. AEA has put together about half the money for upgrading the power lines (45). The community would also like to replace street lights if funding allows.	**Opportunity:** One of the community's top energy priorities is securing full funding for power house upgrades and rebuilding its electrical distribution system. Replacement of most of the existing underground distribution network is part of the RPSU project and should be completed in fall 2015.
Issue: Heat recovery has not been implemented. Water jacket heat recovery can recover 10-20% of the energy lost to heat in diesel systems and use it to lower fuel use and heating costs in nearby buildings. This opportunity is limited in Larsen Bay where diesel has become a backup generation source.	**Opportunity**: If the hydro reservoir and impoundment area are enlarged, study the feasibility of using excess hydro capacity for heating in Larsen Bay. This could be an eligible RE Fund application. Contact the AEA Heat Recovery program manager for more information.
Issue: Operator proficiency and system maintenance are very important to diesel efficiency. In the 2012 RPSU study, operator proficiency was rated as Good or Acceptable in all areas except maintenance. (8) Funders want to see that diesel systems are well maintained and operating efficiently before funding new renewable generation projects.	**Opportunity**: Improve maintenance and planning practices. Provide operators with additional training at AVTEC to increase proficiency in more areas to Good or Excellent levels. No cost for instruction, lodging and per diem for the 2-4 week course. The community is responsible for travel and must have an alternate power plant operator in the interim.
Resources: **State**: AEA Powerhouse and Electrical Distribution Upgrades Program, RPSU program, Heat Recovery program, Circuit Rider program, Power Plant Operator Training. **Federal:** Denali Commission Training Fund.	**Costs and Savings: Distribution system:** $650,000, including street lighting. **Heat Recovery**: Not known. **Diesel Efficiency**: Improving diesel efficiency to 13.0 kWh/gal. would save over 501 gallons of fuel each year and avoid $2,229 in fuel costs. **AVTEC training**: Travel costs to Anchorage.

EMERGING TECHNOLOGIES

Unknown – Tidal or ocean power resources have not been identified in the waters near Larsen Bay, but more detailed resource mapping is likely to occur as these technologies continue to develop. Research and demonstration projects in these and other emerging energy technologies, such as heat pumps, low-power HVDC transmission, and flywheel energy storage systems, should be monitored to assess their potential for providing a local energy solution. The community is taking a "watch and wait" approach. **(45)**

ENERGY EFFICIENCY AND CONSERVATION	
High Potential – The cheapest kilowatt or gallon of fuel is the one you don't have to buy. There is high potential to save on space heating costs and lower electric bills by actively promoting additional residential and commercial EE&C and by having public buildings and facilities (street lights and water/sewer system) audited to identify potential savings.	
Issue: The large majority of the community's housing stock dates from the 1970s and 1980s. Housing of that era in the region are typically 2-star-plus to 3-star homes, with energy costs that are 40-50% higher than a 4-star-plus or 5-star home built since 2000. KIHA recently did audits of all occupied homes, according to Larsen Bay's mayor, and completed weatherization projects on 9 homes. That leaves up to 65% of older homes in Larsen Bay that could still be weatherized.	**Opportunity**: Encourage any remaining residents who are income-eligible to weatherize through AHFC's or KIHA's programs. (Owner-occupied homes already weatherized with NAHASDA funding may be able to achieve additional savings through AHFC's Home Energy Rebate program, which typically achieves higher savings rates.)
Resources: AFHC: Weatherization (through Alaska Community Development Corporation). **KIHA**: U.S. HUD NAHASDA Grants. **KANA:** Regional EE&C Coordination (pending grant funding)	**Costs: State/federal**: Up to $30,000 per home in rural Alaska (including transportation, logistics, overhead and health and safety measures). **Local/regional:** Outreach and coordination costs (not known). **Annual Savings**: 22 MMBTU per home or 78 MMBTU community-wide if all remaining income-eligible homes are weatherized. Equivalent fuel savings are 562 gallons and $3,264 in avoided costs.
Issue: No Larsen Bay residents have participated in AHFC's Home Energy Rebate program, which provides higher energy savings (35%) per home compared with weatherization programs in the region (18% savings) and has no income limits, but requires the house to be owner occupied. Almost all savings are in heating, so increased participation will not reduce electrical loads.	**Opportunity**: AHFC's Roving Energy Rater Program will send a home energy rater to a small community if there 3 homeowners sign up for an audit. A community can increase HER participation rates by actively promoting the program and encouraging residents to sign up or helping them to do so. KANA has applied for an EDA grant to help coordinate and promote EE&C in the region.
Resources: State: AFHC Home Energy Rebate, Weatherization, and Roving Energy Rater programs. **Federal**: U.S. HUD NAHASDA Grants through KIHA. **Regional:** EE&C Coordination through KANA (pending successful EDA grant application)	**Costs: State/federal**: Weatherization: $30,000 per home in rural Alaska (including transportation, logistics, overhead and health and safety measures). Home Energy Rebate: $4,800 (average homeowner rebate). **Local/regional:** Outreach and coordination costs (not known). **Annual Savings**: 40 MMBTU per home or 438 MMBTU community-wide. Fuel savings: 3,142 gallons and $18,253 in avoided fuel costs.
Issue: Nearly 60% of electricity in Larsen Bay is consumed by commercial customers and another 16% by public facilities. Only 22% of the electricity produced is used by residents.	**Opportunity:** Larsen Bay's EE&C strategy should focus on the commercial and public sector. Apply for a village energy efficiency grant for help in upgrading multiple community facilities and infrastructure. Encourage local business owners to apply to AEA's Commercial Building Energy Audit (CBEA) program and follow through on cost-effective measures.

Issue: Before its 2012 energy audit, the Larsen Bay School used over $5,000 in energy per student per year (48). The AHFC audit identified 10 energy saving measures. Statewide, many public facilities have not made recommended improvements despite short payback periods for many recommended measures. KIBSD is in the process of making improvements, especially as repair and replacement needs arise (49).	**Opportunity**: If the school district implements the most cost-effective measures (those with a savings to investment ratio over 1.0), energy costs can be reduced by nearly $26,500 (31%) per year with an investment of $191,000 (payback of 7 years).
Issue: LED street lighting is highly efficient compared to conventional street lights. Though somewhat capital intensive, it can save up to 75% on energy usage on public outdoor lighting. Information on the number, type and wattage of installed lights.	**Opportunity**: The community is seeking money for street lighting as part of its electrical distribution project. Street light upgrades may be financed through grant and loan programs that include energy efficiency among their guidelines.
Resources: **State:** CBEA (commercial enterprises), Alaska DEED Capital Improvements Program (schools). Alaska DCCED Alternative Energy and Conservation Revolving Loan Fund (public and commercial facilities). AHFC Alaska Energy Efficiency Revolving Loan Program (public facilities). **Federal:** USDA RD Rural Energy for America Guaranteed Loan Program (small business), Federal Tax Deduction for Commercial Buildings. DOE-IE START Alaska, other Tribal energy programs.	**Costs**: An investment of $6 to 7 per square foot is typically needed to achieve a 30% energy savings in non-residential buildings, resulting in paybacks of 5-6 years **(15)**. **Savings**: Expect 10-15% annual savings on public facilities EE&C improvements from making only behavioral changes, 15-25% savings if making all the most cost-effective changes, and 25-35% savings if all recommended energy improvements are completed. **Street Lighting:** Estimate $1,000 per light. Communities with populations of 50 to 100 have achieved annual savings of $2,200 (6,150 kWh) with a investments ranging from $5,000 to $18,000 and average payback of 7 years. **(25)**
Issue: Sanitation systems are one of the single largest energy uses in rural communities, accounting for 10% to 38% of community energy use, depending on system type and climate zone.	**Opportunity**: Audit water and sewer system to determine energy use and EE&C opportunities, including the potential for heat recovery or solar thermal installation.
Resources: Tribal: ANTHC. **Federal**: EDA	**Costs:** Not known. **Savings** of $10,000 per year have been achieved in arctic communities. Savings may be lower in Kodiak region due to milder climate. A 10% reduction in energy use in Larsen Bay would save 35 MMBTU per year; 379 gallons of fuel oil; 1,715 kWh; and $2,201 in avoided fuel costs based on modeling.

FOSSIL FUELS

Low Potential – Coal, oil and gas are not known to occur in large quantities in the Kodiak region. Coal beds on Kodiak Island are believed to be thin and likely not an economic resource. The geology also makes it unlikely that commercial quantities of conventional or unconventional oil and gas resources will be discovered. **(16)**

GEOTHERMAL

Low Potential – There are no known geothermal resources in the Kodiak region **(16)**. With high capital costs, ground source heat pumps are economic only where heating costs are high and electric rates are low.

HYDROELECTRIC	
High Potential — Larsen Bay's 475 kW hydroelectric plant met 97% of the communities need for electricity in Fy2013. The community is committed to continued development of hydropower as its top renewable energy priority and is seeking funding to increase capacity and reliability, including an expanded reservoir. The utility has received funding for a new Pelton wheel as part of its 2014-15 Rural Power System Upgrade project. The original hydropower plant went online in 1991 and ownership was transferred from the State of Alaska to the City of Larsen Bay in 2010.	
Issue: Larsen Bay's hydro infrastructure is at risk from beaver activity above the reservoir. After a past event damaged equipment at the cannery, the Tribe and the City are seeking help in preventing future beaver dam breaches. The terrain is rugged making access to the area difficult.	**Opportunity:** Look for funding to assist in dismantling beaver dams incrementally to prevent sudden catastrophic failure. Work with ADF&G to design control methods for preventing future hazards from beaver activity.
Resources: State: AEA Hydroelectric program, Renewable Energy Fund, Power Project Loans, Community Development Block Grants, ADF&G Division of Habitat. **Federal**: Economic Development Administration grants, USDA Rural Development grants, Indian Development Block Grants. **Private**: Partnering with a for-profit entity to take advantage of new market tax credits.	**Costs:** Expanded reservoir: $1.25 million **(45)**. Beaver damage mitigation: unknown. **Savings**: Not known.

INTERTIE
Low Potential – An intertie to Karluk has been looked at in previous studies, which concluded that the cost to construct an 18 to 20-mile intertie between the two communities would exceed potential savings. A 2009 study estimated Larsen Bay to Karluk transmission costs at $5.19 per kWh, using a rough estimate of $400,000 to $500,000 per mile based on statewide data **(26)**. A 1983 study concluded that the cost of an intertie would be higher than the combined cost of hydro or diesel generation alternatives in both communities **(27)**. While an intertie would theoretically allow wind or hydro resources to be tied in anywhere along the route, development of an energy project on National Wildlife Refuge lands or near the Karluk River (with its Wild and Scenic designation) would face additional environmental concerns and permitting challenges. Local interest in a transmission project is not known.

SOLAR	
Medium Potential – Solar does not offer a utility-scale solution in Alaska, but solar PV and solar thermal projects can provide relief for individual homes and facilities, especially those off the grid or that have high summer electric usage. KIHA installed solar hot water heaters in 9 homes in Larsen Bay. The project was grant funded and no data is yet available on whether this provides a cost-effective heating solution for additional homes in the region.	
Issue: Kodiak receives an average of 3 to 3.5 kWh/m^2/day of solar radiation annually, with most coming in April to August. While this is primarily a low-level, seasonal resource, it can provide savings to for	**Opportunity:** A 4 kW fixed-tilt solar PV array on a building can produce 3,373 kWh of AC power per year if the solar panels are kept free of snow. At Larsen Bay's non-PCE rate of $0.44/kWh, that is the equivalent of $1,484 of power purchased from the utility.

Resources: Federal: NREL: Funding, technical support, PVWatts Viewer (calculates potential solar energy production and cost), EPA IGAP, DOE-IE Tribal energy programs. **Other**: Alaskasun.org **(**information, contractors and supplies)	**Costs:** Capital costs: $3 to $10 per watt depending on who does the installation, making the installed cost of a 4kW system $12,000 to $40,000. Costs for a system off the grid need to include the cost of battery storage. **Savings**: Not known.

TRANSPORTATION INFRASTRUCTURE	
Medium Potential - The transportation component of barged fuel prices can be reduced by investing in marine infrastructure that allows fuel to be off-loaded safely and efficiently.	
Issues: Fuel barges currently have to anchor out in Larsen Bay. The community has a small boat harbor but no dock, resulting in reduced competition among vendors and increased price since vendors are either unwilling to deliver to the community or charge more because of the extra time and risk involved.	**Opportunities:** A deepwater dock/moorage has been a top priority for Larsen Bay in recent community and regional plans. In addition to lowering fuel costs a deepwater dock would promote economic development, allowing for expansion in fishing and tourism. The design, engineering and cost analysis for a dock was listed as a strategic project in the 2013 CEDS update, with the city as the lead entity. **(50) (51)**
Resources: State: Alaska DOT&PF STIP, DCCED Designated Legislative Grants. **Federal**: Denali Commission, EDA. **Regional**: Kodiak Island Borough, SWAMC.	**Costs:** $550,000 for feasibility and design costs. **Savings**: It is difficult to estimate the savings on bulk fuel costs since fuel prices fluctuate daily on the world market and vendors' cost data is proprietary.

Wind	
Medium Potential – Wind was recommended as one of three renewable energy pathways for Larsen Bay in the 2010 Alaska Energy Pathway plan. (The others were wood and hydro.) A wind metering study has not been completed, but wind models indicate class 4 to 6 winds. At this point, the community is committed to further developing its hydroelectric resources, so a wind project is not anticipated in the short-term.	
Issue: A wind project will be challenged by small diesel electric loads in Larsen Bay, as well as steep terrain needed to access ridges.	**Opportunity**: Wind is easier to integrate with hydro than with diesel. The hydro dam can be used like a battery to store a few days or weeks of excess energy. **(52)**
Resources: **State**: AEA Anemometer Loan Program, Renewable Energy Fund, Power Project Loans, Community Development Block Grants. **Federal**: Economic Development Administration grants, USDA Rural Development grants, Indian Development Block Grants. **Private**: Partnering with a for-profit entity to take advantage of new market tax credits.	**Costs:** Feasibility study: $70,000.

Community and Regional Plans		
Year	Report Title (Author)	Community-specific, Energy-related Recommendations
2013	Kodiak Rural Regional Comprehensive Economic Development Strategy (Kodiak Area Native Association)	1. Design, engineering and cost analysis of deepwater dock/moorage.
2009	Kodiak Island Borough Regional Energy Plan (Kodiak Island Borough Community Development Department)	1. Install wind metering tower to determine wind potential. 2. Feasibility study on enlarging reservoir towards a long-term energy goal of 100% hydropower. 3. Study tidal potential. 4. Build road from Karluk to Larsen Bay to create hydropower inter-tie. 5. Replace older appliances with energy efficient appliances. 6. Upgrades required on distribution lines and transformers. 7. Diesel generator requires upgrade. 8. New efficient lights for the boat harbor, city buildings, school and public buildings.
2004	Larsen Bay Community Plan (Roberta J. Townsend Vennel, AtokaSystems)	1. Develop deep-sea dock to position Larsen Bay to capitalize on its unique location on the west side of the Shelikof Straits. 2. Develop basic infrastructure repairs and improvements.
2003 Update to 2001	Kodiak Region Comprehensive Economic Development Strategy - Revised (Kodiak Chamber of Commerce)	1. Water system improvement.

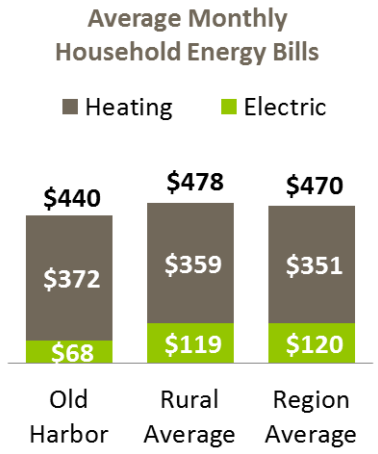
OLD HARBOR

Community Map
OLD HARBOR
57° 12' 50" N 153° 17' 03" W (NAD 83)
Approximate Elevation: 37' at ALCAP, "Tr. E L1/L2"
Township 34 South, Range 25 West, S.M., AK
U.S.G.S. Quadrangle "KODIAK A-4", Alaska
KODIAK RECORDING DISTRICT

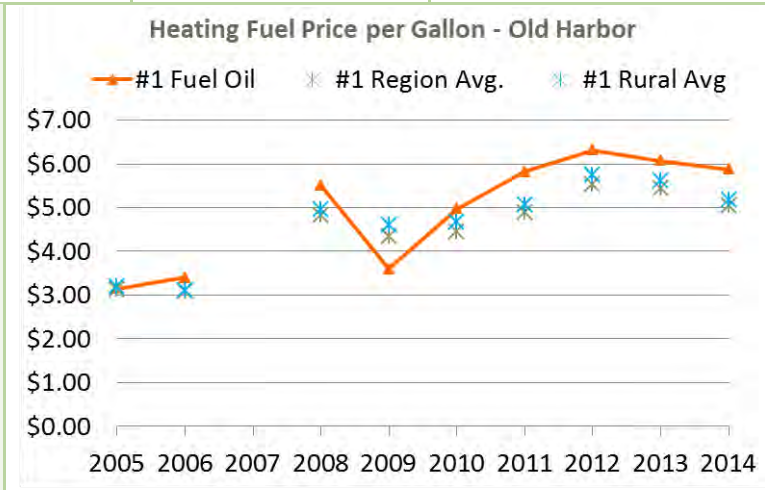
LEGEND
- Residential Building
- Commercial Building
- Public Building
- Electric
- Underground Telephone
- Underground Telephone Subject to 10' wide esmt. Bk. 107, Pgs. 169-184 5/28/1991
- Sewer Line
- Water Line
- Fuel Line
- Edge of Water

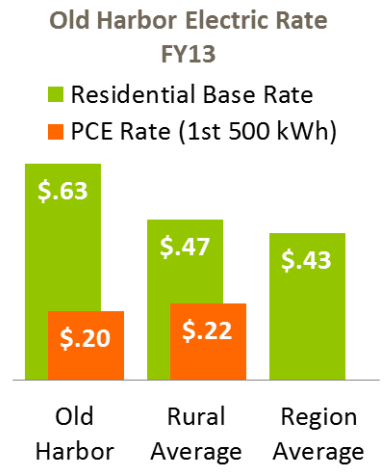
Community Energy Priorities[1]	Priorities	Concerns
	Hydro: Continue design, permitting, and construction	- Aging housing stock is unsafe and inefficient - Need to determine what type of wood is best for burning and the benefits and risks for both the household and the environment of burning wood - Energy efficiency funding and training - Air quality
	Education to improve overall efficient use of power	
	Continue work on mill to manufacture wood pellets	
	Energy Efficiency: 1) Public Buildings, 2) Homes, old division, 3) Commercial	
	Continue investigation into wind potential	
	Improve waters lines, reduce leakage and costs	
Stakeholders Groups	City of Old Harbor (operates water utility and share of tank farm)	
	Old Harbor Native Corporation	
	AVEC (electric utility)	
Energy Champions[1]	Cynthia Berns (Old Harbor Native Corp)	
Sources: **(20) (2) (53)**. **Notes**: 1/ Based on Phase II input.		

TOTAL ENERGY USE			
Electrical Generation	**Diesel**: 845 MWh **Renewable**: 0	Sold: 775 MWh	**Line Loss**: 4.9% **Powerhouse**: 3.4%
Community Load (2)	**Average** 73 kW **Peak**: 162 kW	**Electric Customers**	**Residential**: 95 **Community Facilities**: 120 **Other (Non-PCE)**: 19
Annual Fuel Use	**Electric**: 58,192 gals.	**Space Heating**: (2) 108,334 gals	**Transportation**: (2) 28,976 gals
Fuel Price	**Electric**: $4.13/gal.	**Heating**: $5.87/gal. of #1 Oil (Jan. 2014) (5)	**Transportation**: NA

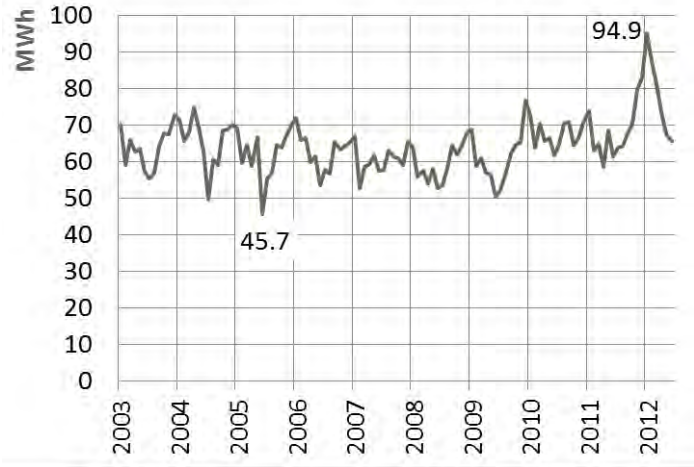


Heating Fuel Cost (5)

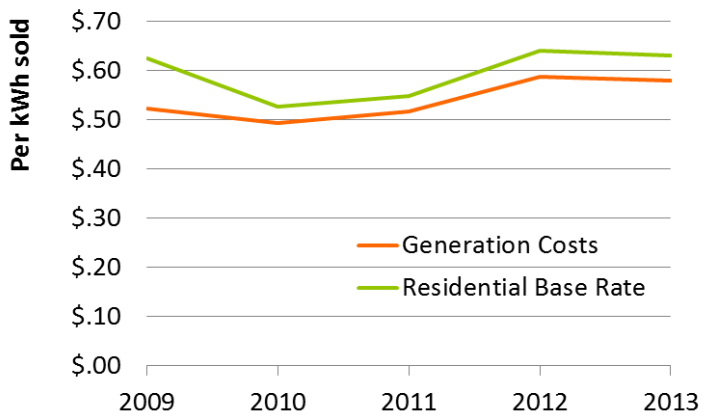
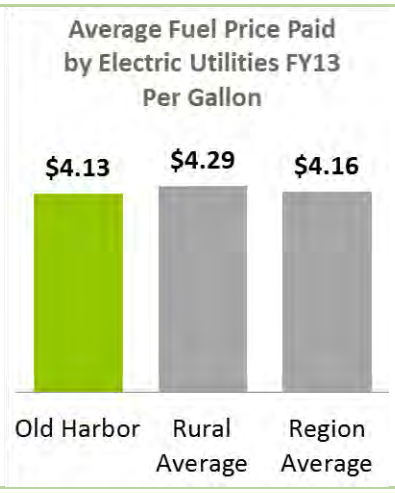
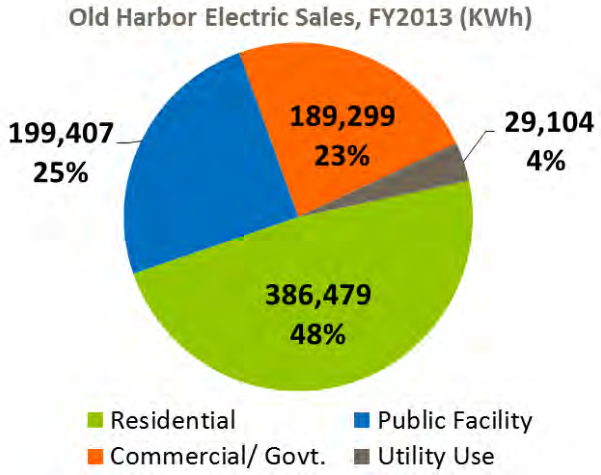
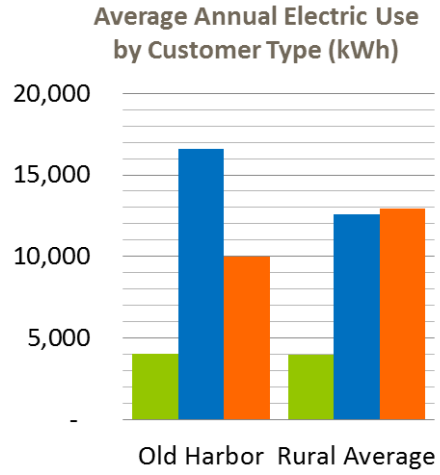




Electrical Generation (5)



Sources (except as noted): **(7)**.

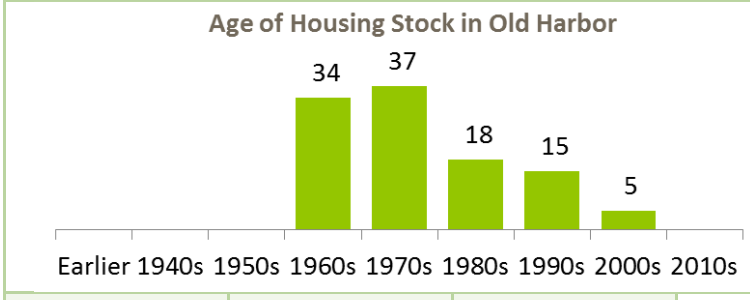
ELECTRIC GENERATION			
Utility	Alaska Village Electric Cooperative - AVEC		
PCE (level)	Active ($0.43/kWh)	RPSU Upgrade	Not known.
Diesel Capacity	G1: 45 kW. G2: 101 kW. G3: 190 kW	Renewable Capacity	0
Diesel Generators	G1: Caterpillar 3306 – Fair G2: Caterpillar 3306 – Fair G3: Detroit Diesel S60 – Fair	Load Sizing	Properly sized
		Load Imbalance	10-25% Imbalance
Diesel Efficiency	14.53 kWh/gallon	Switchgear	Manually synchronizing switchgear
Residential Rate	**Effective**: $0.20/kWh (1st 500 kWh). **Base**: $0.63/kWh	Cost per kWh Sold	**Fuel**: $0.31; **Non-Fuel**: $0.27 **Total cost**: $0.58
Operator Proficiency	**Excellent**: Routine Maintenance, logs, etc. **Good:** Scheduled maintenance and planning	Heat Recovery	No
Known Issues	Birds cause phase to phase shorts which leads to local service interruptions.		
Generation Costs			
Electric Sales by Customer Type			

Sources (except as noted): **(7) (8)**

ENERGY EFFICIENCY AND CONSERVATION

Residential

Occupied Housing Units	Housing Type, including Vacant	Average Home Size (est.)[1]	Avg. HH Size / Overcrowding	Median HH Income	Energy Cost as a % of Income
73	113 Single Family	1,056 sf	2.9 / No	$50,179	11%

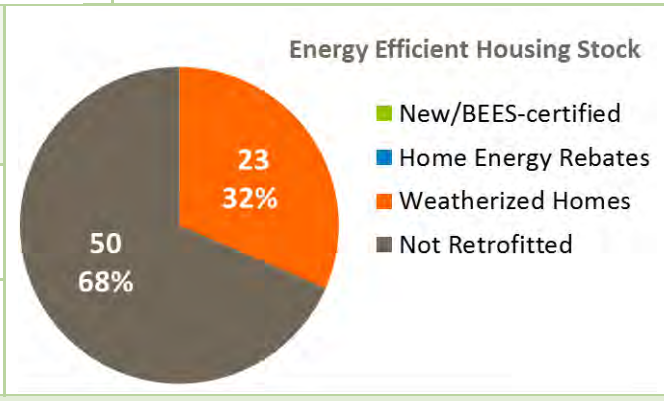


Estimate Annual Energy Use per Home	Average Annual Home Energy Bill
124 MMBTU	$5,281

Note: Older homes are typically less energy-efficient than newer homes, due to improvements in building technology and energy efficiency over time.

Annual Home Energy Savings Achieved	Additional Annual Home Energy Savings Opportunity	Percent of Residential EE&C Work Remaining
524 MMBTU 3,761 gals. $22,075	1,997 MMBTU 14,338 gals $84,165	68%

Assumptions: Average energy savings for region based on 2008-13 ARIS data (35% HER, 18% AHFC weatherization projects). Retail fuel cost: $5.87/gal.



Non-residential

No. of Public/ Commercial Buildings[2]	Types of Non-residential Buildings	Est. Annual Energy Use per Building[3]	Non-residential Buildings Audited	Non-residential EE&C Measures Identified	Non-residential EE&C Savings Achieved[4]
31	See Appendix B	1,178 MMBTU	See Appendix B	See Appendix B	41% lighting 17% fuel
Street Light Number	**Street Lighting Type**	**LED Street Lighting Upgrade**	**Street Lighting Remaining Opportunity**	**Estimated Cost of LED Street Light Retrofit[4]**	**LED Street Lighting Annual Energy Savings[5]**
Not Known	Not Known	No	100%	$1,000 per light or $14,000 to $28,000 total	6,000 to 18,000 kWh $2,500 to 8,500
Water & Sewer System Type / No. of Homes Served	**Water and Sewer Rates**	**Estimated Annual Water & Sewer Energy Use[1]**	**Sanitation System Energy Audit Performed**	**Estimated Cost of Water & Sewer EE&C Upgrades**	**Estimated Annual Water & Sewer Energy Savings[6]**
Water: Pressure Sewer: Gravity 73 Homes	NA	750 MMBTU 4,487 gals. 36,826 kWh	Not Known (Lighting upgraded in 2005-06 VEEP)	Not Known	75 MMBTU 703 gals. 3,683 kWh $4,124

Sources: (9) (10). **Notes**: 1/ Based on Energy End-Use Study data (11). 2/ Based on number of electric rate payers. 3/ Based on Energy End-Use Study and 2013 Alaska Housing Assessment data (11) (12). 4/ Fuel savings in 3 buildings. Lighting in 7 buildings. 5/ ARIS data for communities of 50 to 100 people. 6/ Assumes 10% savings on fuel and electric.

DIESEL EFFICIENCY AND HEAT RECOVERY					
Annual Savings from Diesel Efficiency Increase of 5%[1]	Heat Recovery Installed at Power Plant	**Buildings Heated with Waste Heat**	Additional Heat Recovery Opportunity	**Estimated Cost of Water Jacket Heat Recovery**	**Est. Annual Savings from Water Jacket Heat Recovery**
2,765 gals. $11,418	No	No	NA	Capital cost: $200,000 and up	534 MMBTU[2] or 10 to 20%

BULK FUEL			
Capacity (54)	**Tank Farm (City shared with school)**: 120,000 **Tank Farm (AVEC)**: 39,900	Fuel Purchase	City of Old Harbor has a bulk fuel purchasing agreement with AVEC; fuel for both city and AVEC tanks is delivered at same time.
Bulk Fuel Upgrade	Completed in 2001; Two 27,000 gallon tanks installed in city tank farm in 2012 for airport upgrade.	Vendors	Petro Marine
By Barge	Fuel delivered by barge 4 times/ year		
By Air	No		
Cooperative Purchase	Already in place.		

Sources (except as noted): **(53)**. **Notes**: 1/ Based on FY2013 PCE data **(7)**. 2/ 2010 Alaska Energy Pathway estimate has not been updated or verified **(4)**.

ENERGY PLANNING

BIOMASS

Unknown – The 2010 Alaska Energy Pathway plan identified wood as one of the renewable resources available to Old Harbor, yet the area is characterized by high brush vegetation and alpine tundra. The community has one fish processor with an unknown potential to provide fish oil for use as biofuel. There are no sawmills to provide wood and no class 1 landfills to supply solid waste in sufficient quantities for a heat or combined heat and power project.

Issue: Dominant vegetation types include shrubs and grasses with few trees. The federal government owns significant land holdings near Old Harbor, which are protected as part of the Kodiak National Wildlife Refuge. Other lands near the community are owned by village or regional Native corporations.	**Opportunity**: If the community is interested in using woody biomass to heat one of its community buildings, a reconnaissance study can assess whether there is a sufficient forest resource available to the community to sustain a modestly scaled project, such as a GARN boiler.
Issue: Wood biomass projects have the added benefit of creating local jobs as wood cutters and boiler operators, but they require strong community leadership and interest to succeed. To date, biomass is not one of the renewable energy technologies the community has expressed interest in.	**Opportunity**: Economic development is a priority in Old Harbor, which is promoting efforts to improve infrastructure, bring down cost of living and increase employment opportunities. A community biomass project with strong local champions could provide both skilled and unskilled jobs, while reducing heating costs and diesel dependence. If community members are interested, there are several programs to help them explore biomass options.
Issue: In Alaska, biodiesel is primarily manufactured from fishmeal processors, not those who produce whole fish, fillets or canned salmon. Most is used onsite by processors themselves or may be exported as animal feed supplements or for other uses. Currently, a lot of fish waste is ground up and dumped into the ocean where it can disrupt marine ecosystems.	**Opportunity**: Biodiesel can be blended with #2 diesel or used directly in generators, other engines, boilers and fishmeal dryers. If not processed immediately, fish waste degrades rapidly and quickly loses its value. To make biodiesel manufacture attractive, diesel prices must be high enough to offset capital costs for equipment to extract oil from fish waste.

Resources: State: UAF Alaska Wood Energy Development Task Group (AWEDTG) pre-feasibility studies), AEA Biomass Program (technical assistance), AEA Renewable Energy Fund (grants). **Federal**: USDA-RD Rural Energy for America Program (small business or agricultural producers).	**Costs and savings**: Fish and solid waste systems: unknown. Woody biomass: No cost to community for pre-feasibility study through AWEDTG grant. System cost: $100,000 minimum. Annual O&M: $500 plus 1 hour labor per day. **(15)** Savings depends on size of system and local cost of wood. $250 to $300 per cord provides the same amount of heat as fuel oil at $3.50 per gallon.

DIESEL EFFICIENCY AND HEAT RECOVERY	
Medium Potential - Diesel is currently used to generate 100% of Old Harbor's electricity. There is an opportunity to improve the operation of the community's powerhouse, particularly as it affects successful integration with the proposed hydro facility.	
Issue: Old Harbor's power plant is in good repair and the generators have an average diesel efficiency rate of 14.5 kWh/gal. (7) (8).	**Opportunity:** Ensure the powerhouse and distribution lines are in top condition for efficient integration with future hydro plant, including installing automatic paralleling switchgear, balancing three phase power to increase diesel efficiency and reliability, and addressing line loss **(14)**. Increase efficiency by 5% to 15.3 kWh/gal.
Issue: Heat recovery has not been implemented at the Old Harbor powerhouse. The potential for savings from heat recovery may be limited in future if electrical generation comes primarily from hydropower, but could still be an option if there is excess hydro capacity.	**Opportunity**. Water jacket heat recovery can recover 10-20% of the energy lost to heat in diesel systems, lowering heating costs in nearby buildings. Assess near-term costs and benefits on installing heat recovery in the diesel powerhouse and future potential for electric heat dump loads from excess hydro. This could be an eligible RE Fund application. Contact AEA Heat Recovery program manager.
Resources: State: UAF Alaska Wood Energy Development Task Group (AWEDTG) pre-feasibility studies), AEA Biomass Program (technical assistance), AEA Renewable Energy Fund (grants). **Federal**: USDA-RD Rural Energy for America Program (small business or agricultural producers).	**Diesel Efficiency:** Costs not known. Savings: Increasing diesel efficiency by 5% to 15.3 kwh/gal. would save 2,765 gallons and more than $11,400 per year. **Heat Recovery:** Capital costs were modeled at $226,695 in 2010 with annual O&M costs of $6,801, and annual savings of $236,000 per year. (Note: These estimates from the 2010 Alaska Energy Pathway have not been updated or verified). **(2)**

EMERGING TECHNOLOGIES
Unknown – Early reconnaissance models suggest that tidal energy at Whale Passage near Port Lions and Ouzinkie Narrows may have potential. No sites near Old Harbor have been identified, but more detailed resource mapping is likely to occur as these technologies continue to develop. Research and demonstration projects in these and other emerging energy technologies should be monitored to assess their potential for providing future energy solutions.

ENERGY EFFICIENCY AND CONSERVATION	
High Potential – Old Harbor has already completed the VEEP retrofit program and should continue saving on energy costs by actively promoting additional residential and commercial EE&C. Opportunity also exists in retrofitting street lights in Old Harbor.	
Residential Energy Efficiency	
Issue: Sixty-five percent of the community's housing stock was built before 1980. Housing of that age in the region typically is rated at only 2 or 2-star-plus, with energy costs that are 50-75% higher than a 4-star-plus or 5-star home built in the 2000s. Sixty-eight percent of the residential homes in Old Harbor have not been weatherized.	**Opportunity**: Encourage remaining residents who are income-eligible to weatherize through AHFC's or KIHA's programs. For owner-occupied homes, even if already weatherized, there is an opportunity for additional savings through AHFC's HER program.
Issue: No Old Harbor residents have participated in AHFC's Home Energy Rebate program, which provides higher energy savings (35%) per home compared with weatherization programs in the region (19% savings) and has no income limits, but requires the house to be owner occupied.	**Opportunity**: AHFC's Roving Energy Rater Program will send a home energy rater to a small community if there 3 homeowners sign up for an audit. A community can increase HER participation rates by actively promoting the program and encouraging residents to sign up or helping them to do so. KANA has applied for an EDA grant to help coordinate and promote EE&C in the region.
Resources: State: AFHC Home Energy Rebate, Weatherization, Roving Energy Rater. **Federal**: U.S. HUD NAHASDA Grants through KIHA. **Regional:** EE&C Coordination through KANA (pending grant application)	**Costs: State/federal**: Weatherization: $30,000 per home in rural Alaska (including transportation, logistics, overhead and health and safety measures). Home Energy Rebate: $4,800 (average homeowner rebate). **Local/regional:** Outreach and coordination costs (not known). **Annual Savings**: Energy**:** 1,997 MMBTU. Fuel (gallons): 14,338. Fuel (cost): $88,165.
Non-residential Energy Efficiency	
Issue: Old Harbor completed a village-wide lighting retrofit on 7 public buildings in 2005-06 with additional savings from thermostat setbacks and boiler controls on a few buildings. There is no record in state EE databases of other energy efficiency measures or audits being performed on non-residential community or commercial buildings	**Opportunity**: There is significant opportunity for savings from upgrades to the building envelope, ventilation, mechanical systems, and refrigeration in non-residential buildings. Apply for audits through AFHC's Commercial Energy Audit program and encourage business owners to apply to AEA's Commercial Building Energy Audit (CBEA) program. EE&C paybacks are generally short enough to make upgrades worth pursuing even if funding only covers audits and not upgrades.
Issue: There is no record of LED street lighting retrofits in Old Harbor.	**Opportunity**: LED street lighting is highly efficient compared to conventional street lights. Though somewhat capital intensive, it can save up to 75% on energy usage on public outdoor lighting. Information on the number, type and wattage of installed lights.

Resources: **State:** CBEA (commercial enterprises), Alaska DEED Capital Improvements Program (schools). Alaska DCCED Alternative Energy and Conservation Revolving Loan Fund (public and commercial facilities). AHFC Alaska Energy Efficiency Revolving Loan Program (public facilities). **Federal:** USDA RD Rural Energy for America Guaranteed Loan Program (small business), Federal Tax Deduction for Commercial Buildings. DOE-IE START Alaska, other Tribal energy programs.	**Costs**: An investment of $6 to 7 per square foot is typically needed to achieve a 30% energy savings in non-residential buildings, resulting in paybacks of 5-6 years **(15)**. **Savings**: Expect 10-15% annual savings on public facilities EE&C improvements from making only behavioral changes, 15-25% savings if making all the most cost-effective changes, and 25-35% savings if all recommended energy improvements are completed. **Street Lighting:** $1,000 per light or $14,000 to $28,000 in total project costs for communities of 100-250 people. Savings: 6,000 to 18,000 kWh per year. **(25)**

FOSSIL FUELS

Low Potential – Coal, oil and gas are not known to occur in large quantities in the Kodiak region. Coal beds on Kodiak Island are believed to be thin and likely not an economic resource. The geology also makes it unlikely that commercial quantities of conventional or unconventional oil and gas resources will be discovered. **(16)**

GEOTHERMAL

Low Potential – There are no known geothermal resources in Kodiak region **(16)**. Ground source heat pumps have high capital costs and are typically economic only where heating costs are high and electric rates are low.

HYDROELECTRIC

High Potential — Significant work has already been done on design and permitting for a hydroelectric facility in Old Harbor. A top priority of Old Harbor and AVEC, the proposed hydroelectric facility will be capable of producing 2,018 MWh with a capacity of 262 kW. The facility will operate year round and is designed to meet all existing and future electricity needs of Old Harbor. AVEC and the city of Old Harbor are seeking funding for the next phase of development: Final Design and Permitting.

SOLAR

Medium Potential – Solar does not offer a utility-scale solution for Old Harbor, but solar PV and solar thermal projects can provide relief for individual homes and facilities. Kodiak receives an average of 3 to 3.5 kWh/m^2/day of solar radiation annually, with most coming in April to August. A 4 kW fixed-tilt solar PV array on a building in Kodiak can produce 3,373 kWh of AC power per year if the solar panels are kept free of snow. At Old Harbor's non-PCE rate of $0.63/kWh, that is the equivalent of $2,125 of power purchased from the utility. KIHA outfitted 18 households in Old Harbor with solar hot water systems. The project was grant funded and no data is yet available on whether this provides a cost-effective heating solution for additional homes in the region.

Issue: If more households or businesses meet some of their electrical needs through self-generation, the challenges of integrating new utility-scale renewable resources into a small load intensify.	**Opportunity:** Using solar technologies to reduce space and hot water heating costs may be more economical than using solar to generate electricity and will not reduce the utility's electric load. However, systems are significantly more complex to set up and maintain than PV arrays and so having trained and knowledgeable operators is important.

Resources: Federal: NREL (funding, technical support), PVWatts Viewer (calculates potential solar energy production and cost), EPA IGAP, DOE-IE Tribal energy programs. **Other**: Alaskasun.org **(**information, contractors and supplies)	**Costs:** Capital costs: $3 to $10 per watt depending on who does the installation, making the installed cost of a 4kW system $12,000 to $40,000. Costs for a system off the grid need to include the cost of battery storage. **Savings**: Not known.

TRANSPORTATION INFRASTRUCTURE

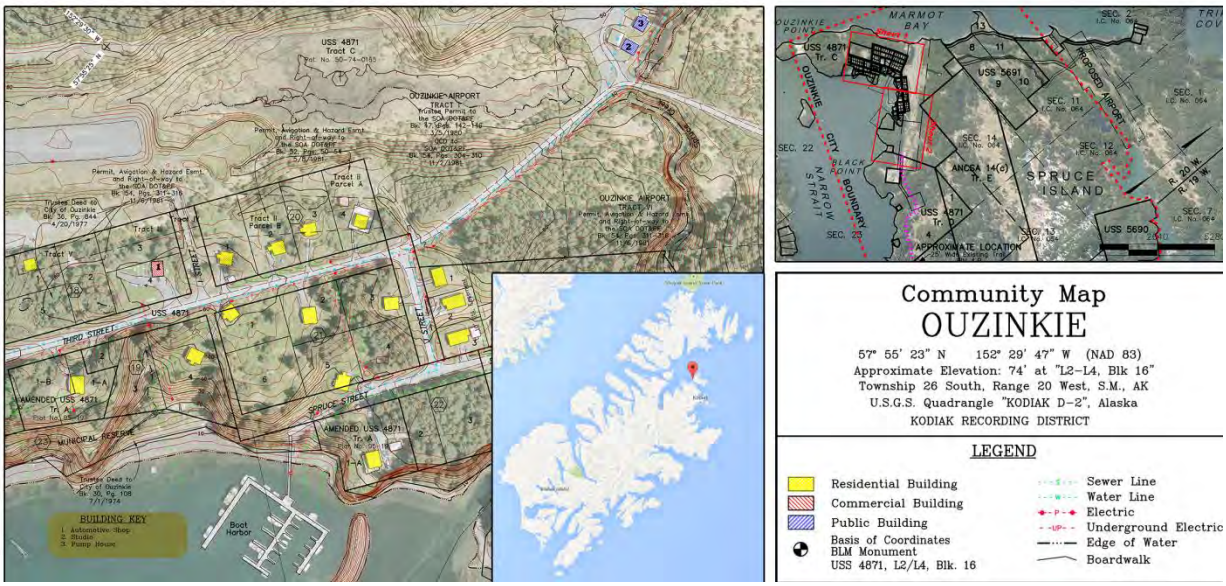
Low Potential – Old Harbor's city dock was replaced with a 56' wide by 102' long dock in 2012. With general lighting and navigation lights and 825 linear feet of fuel pipe and a fuel header, the new dock allows fuel barges to offload fuel to the tank farm **(55)**.

WIND

Medium Potential –A met tower installed on a peninsula of Sitkalidak Island collected seven months of data. The test site was expected to show the best potential for wind power development in Old Harbor. The data showed a marginal wind resource **(56)**. A met tower was installed in a new location to determine an alternative site for a wind turbine.

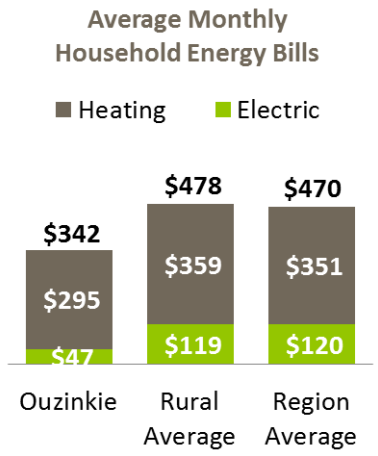
COMMUNITY AND REGIONAL PLANS		
Year	REPORT TITLE (AUTHOR)	**Community-specific, Energy-related Recommendations**
2013	Kodiak Rural Regional Comprehensive Economic Development Strategy (Kodiak Area Native Association)	1. Replace current diesel generation with hydroelectric. 2. Airport improvements.
2009	Kodiak Island Borough Regional Energy Plan (Kodiak Island Borough Community Development Department)	1. Follow through on installation of solar hot water heaters and installation of newer appliances. 2. Feasibility study on tidal energy source. 3. Wind generation study demonstrated that wind is not consistent enough to provide a means of alternate energy. 4. Initial planning with AVEC regarding hydro power.
2008	Kodiak Island Borough Comprehensive Plan Update (Kodiak Island Borough)	1. Upgrade the current boat harbor and develop a deepwater dock and bulkhead system that will accommodate additional freight services, especially gas and building materials. 2. Expand air access through airport expansion. 3. Monitor alternative energy sources, implementing when they become feasible. 4. Develop hydroelectric facility in town.
2005	Community of Old Harbor, Alaska Community Plan, Visions, Goals and Action Plans	1. Upgrade boat harbor and develop deepwater dock and bulkhead system. 2. Determine what alternative energy approach would work best for Old Harbor. 3. Improve air traffic access to and from Old Harbor via a new airport capable of handling up to a C-130 cargo plane. 4. Provide a well-maintained and viable road system in Old Harbor. 5. Provide additional or improved docking facilities to handle marine traffic in Old Harbor. 6. Erosion control. 7. Requested to be included in the Terror Lake Intertie. 8. Remove dangerous fuel tanks that are located near the shoreline and begin utilizing an 80,000 gallon tank farther inland.
2003 Update to 2001	Kodiak Region Comprehensive Economic Development Strategy - Revised (Kodiak Chamber of Commerce)	1. Harbor improvements. 2. Airport and harbor power. 3. Hydro project.
1989	Comprehensive Plan and CIP, Old Harbor, City of the Three Saints	1. Upgrade current 480 volt electrical system to the standard 7200 volt system. 2. Divide town into separate grids for ease of maintenance on system. 3. Continue to monitor alternative energy sources and will implement alternative sources when they become feasible.

OUZINKIE

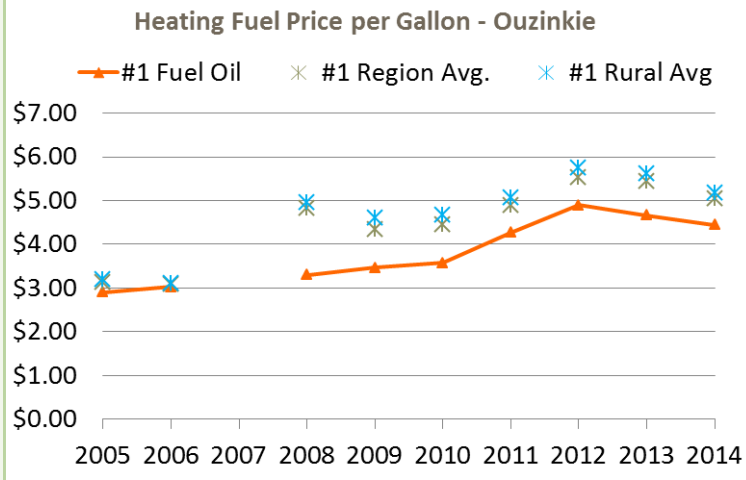


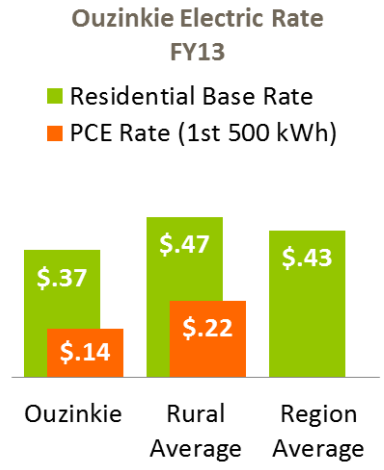
Community Energy Priorities[1]	Priorities	Concerns
	Propane costs are high and must be re-filled in Kodiak; interest in bulk refill facility	- Backhaul - Road re-surfacing - Greenhouses - Food security
	Significant lumber and saw mill activity in Ouzinkie; clustering of buildings presents possibility for biomass district heating loop	
	Upgrade distribution lines	
	More small scale solar PV and solar thermal	
Local Stakeholders Groups	City of Ouzinkie (operates all utilities)	
	Ouzinkie Native Corporation (landowner, tank farm owner)	
	Native Village of Ouzinkie (federally recognized tribe)	
Energy Champions[1]	Dan Clarion (mayor/utility manager), Ouzinkie Native Corp. (landowner)	
Sources: **(20) (2) (57)**. **Notes**: 1/ Based on Phase II input.		

Total Energy Use			
Electrical Generation	**Diesel**: 515 MWh **Renewable**: 239 MWh	**Sold**: 690 MWh	**Line Loss**: 3.7% **Powerhouse**: 4.8%
Community Load [RE Vi 982]	Average 100 kW Peak: 170 kW Minimum: 70 kW	**Electric Customers** (7)	**Residential**: 77 **Community Facilities**: 10 **Other (Non-PCE)**: 22
Annual Fuel Use	**Electric**: 40,800 gals	**Space Heating**: 78,788 gals (4)	**Transportation**: 21,073 gals (4)
Fuel Price	**Electric**: $4.76/gal	**Heating**: $4.44/gal of #1 Oil (Jan. 2014) (5)	**Transportation**: NA

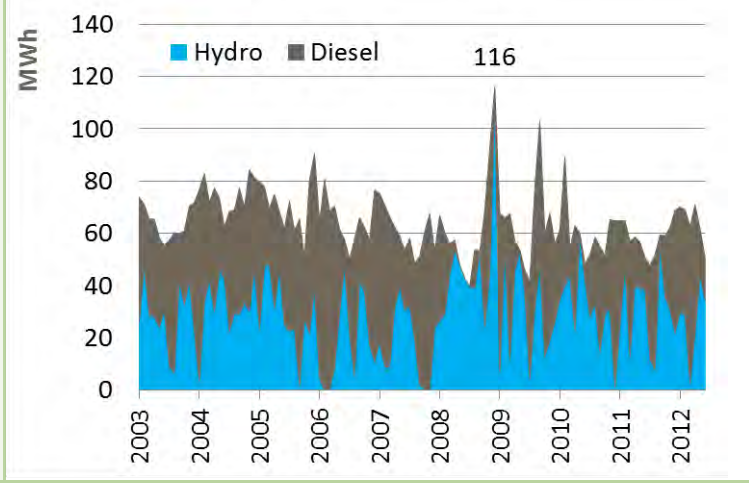


Heating Fuel Cost (5)

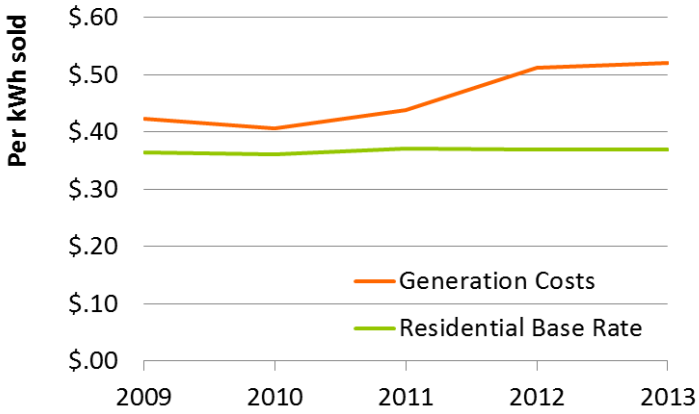
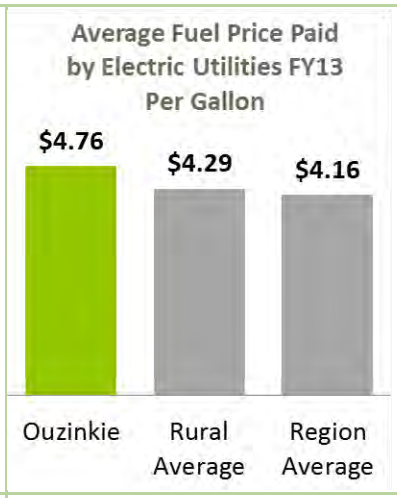
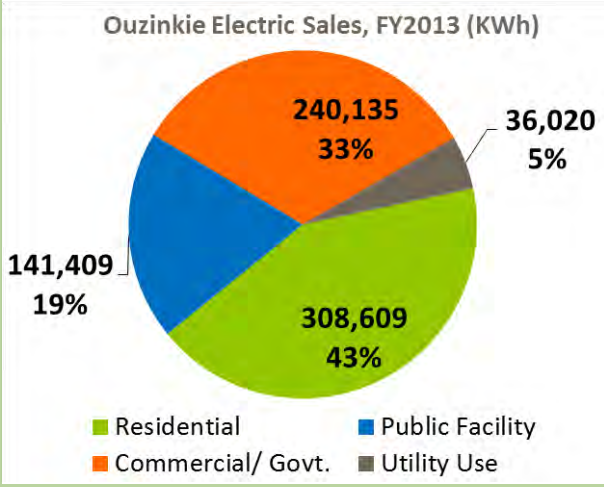
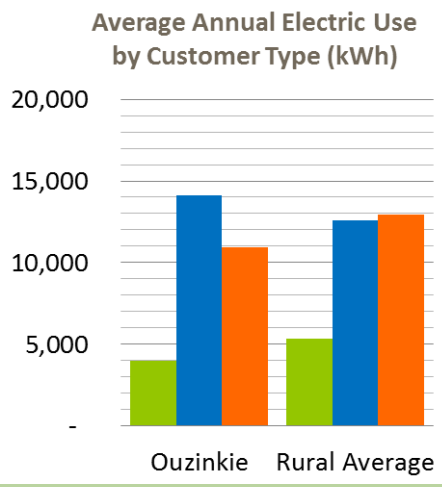




Electrical Generation (5)



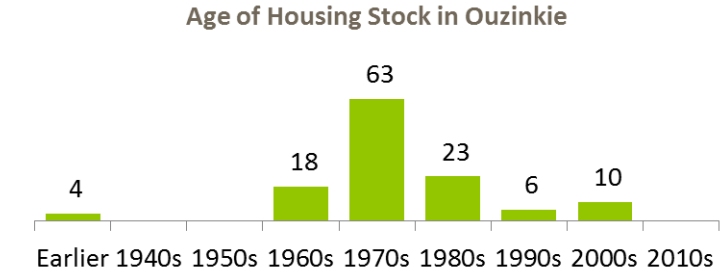
Sources (except as noted): **(7)**

Electric Generation			
Utility	City of Ouzinkie		
PCE (level)	Active ($0.22/kWh)	**RPSU Upgrade**	Completed
Diesel Capacity	**G1**: 45 kW / **G2**: 101 kW / **G3**: 190 kW	**Renewable Capacity**	125 kW
Diesel Generators	**G1**: John Deere 4045 – Like new **G2**: John Deere 6068 – Like new **G3**: John Deere 608 - Fair	**Load Sizing**	Properly sized
		Load Imbalance	10-25%
Diesel Efficiency	12.6 kWh/gal.	**Switchgear**	Parallel switchgear. Fully automatic synchronizing switchgear
Residential Rate	**Effective**: $0.14/kWh (1st 500 kWh). **Base**: $0.37/kWh	**Cost per kWh Sold**	**Fuel**: $0.28; **Non-Fuel**: $0.24 **Total cost**: $0.52
Operator Proficiency	**Acceptable**: Routine Maintenance, logs, etc. **Unacceptable:** Scheduled maintenance and planning (8)	**Heat Recovery**	This section of the RPSU survey was not completed.
Known Issues	Hydro system not able to run at capacity because penstock and dam are failing. Outages from sync issues with hydro system. Distribution system needs major repairs. Meters corroded, need replacing (customer problem) **(8)**.		
Generation Costs			
Electric Sales by Customer Type			
Sources (except as noted): **(7) (8)**			

Energy Efficiency and Conservation

Residential

Occupied Housing Units	Housing Type, including Vacant	Average Home Size (est.)[1]	Avg. HH Size / Overcrowding	Median HH Income	Energy Cost as a % of Income
103	105 SF, 6 Duplex, 13 MF	1,056 sf	2.9 / No	$34,375	15%

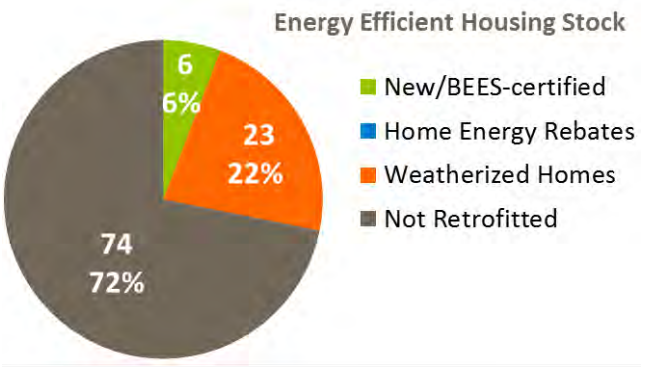


Estimate Annual Energy Use per Home	Average Annual Home Energy Bill
122 MMBTU	$4,104

Note: Older homes are typically less energy-efficient than newer homes, due to improvements in building technology and energy efficiency over time.

Annual Home Energy Savings Achieved	Additional Annual Home Energy Savings Opportunity	Percent of Residential EE&C Work Remaining
515 MMBTU 3,696 gals. $17,370	1,288 MMBTU 9,250 gals. $43,474	72%

Assumptions: Average energy savings for region based on 2008-13 ARIS data (35% HER, 18% AHFC weatherization projects). Retail fuel cost: $4.70/gal.



Public and Commercial Buildings

No. of Public/ Commercial Buildings[2]	Types of Non-residential Buildings	Est. Annual Energy Use per Building[3]	Public or Commercial Building Audits	Non-residential EE&C Measures Identified	Non-residential EE&C Measures Implemented
32	See Appendix B	1,178 MMBTU	School		None reported

Other Community Infrastructure

Street Light Number	Street Lighting Type	LED Street Lighting Upgrade	Street Lighting Remaining Opportunity	Estimated Cost of LED Street Light Retrofit[4]	LED Street Lighting Annual Energy Savings[4]
Not Known	Not Known	In progress	Not Known	$1,000 per light or $10,000 to $30,000 total	3,000 to 9,700 kWh / $1,900 to $4,200
Water & Sewer System Type / No. of Homes Served	**Water and Sewer Rates**	**Estimated Annual Water & Sewer (W&S) Energy Use[1]**	**Sanitation System Energy Audit Performed**	**Estimated Cost of Water & Sewer EE&C Upgrades**	**Estimated Annual Water & Sewer Energy Savings[5]**
Water: Pressure Sewer: Gravity 80 Homes	$88/month If not subsidized (57)	1,059 MMBTU 6,330 gals. 51,961 kWh	No	NA	106 MMBTU 1,045 gals. 5,196 kWh

Sources: (9) (10). **Notes**: 1/ Based on Energy End-Use Study data (11). 2/ Based on number of electric rate payers (7). 3/ Calculated based on Energy End-Use Study and 2013 Alaska Housing Assessment data (11) (12). 4/ Based on ARIS data for communities of 100 to 250 people. 5/ Assumes 10% savings on fuel and electric.

Diesel Efficiency and Heat Recovery					
Annual Savings from a Diesel Efficiency of 13.0 kWh/gal.[1]	Heat Recovery Installed at Power Plant	Buildings Heated with Waste Heat	Additional Heat Recovery Opportunity	Estimated Cost of Water Jacket Heat Recovery	Est. Annual Savings from Water Jacket Heat Recovery
1,178 gals. $5,605	No	0	NA	Capital cost: $200,000 and up	824 MMBTU[2] or 10 to 20%

Bulk Fuel			
Capacity (58)	**Tank Farm**: 71,600 **School**: 5,200 **City**: 1,400	**Fuel Purchase**	City and utility purchase fuel from Ouzinkie Native Corp. which owns the tank farm.
Bulk Fuel Upgrade	Completed	**Vendors**	Petro Marine Services
By Barge	Fuel delivered by barge. With Ouzinkie's new dock, there are no issues with fuel delivery.		
Cooperative Purchase	Ouzinkie would most likely not be interested I a cooperative bulk fuel purchasing program because of barge access issues in some communities. **(57)**		

Sources (except as noted): (57). **Notes**: 1/ Based on FY2013 PCE data (7). 2/ 2010 Alaska Energy Pathway estimate has not been updated or verified (4).

ENERGY PLANNING

Biomass

Medium Potential – Spruce Island has an abundance of tall spruce, and the 2010 Alaska Energy Pathway plan identified wood as one of the renewable resources available to Ouzinkie. The community has no fish processors to supply fish oil for biofuels, but is near processing facilities in Kodiak. There are no class 1 landfills to supply sufficient quantities of solid waste to fuel a heat or combined heat and power plant.

Issue: There is an abundance of tall spruce on the island. The Ouzinkie Native Corporation is the majority landowner, with other lands in private ownership. Sufficient biomass may exist to sustain a modestly scaled project, such as a GARN boiler, that could heat community building(s) in Ouzinkie.	**Opportunity:** Dry spruce can provide 19-22 MMBTU per cord. The UAF Alaska Wood Energy Development Task Group has an easy application process to request funding for a reconnaissance study to assess the forest resources available to the community.
Issue: Wood biomass projects have the added benefit of creating local jobs as wood cutters and boiler operators, but they require strong community leadership and interest to succeed. To date, biomass is not one of the renewable energy technologies the community has expressed interest in.	**Opportunity:** Economic development is a priority in Ouzinkie which has been recovering from the decline in its fishing industry. A community biomass project with strong local champions could provide both skilled and unskilled jobs, while reducing heating costs and diesel dependence. If community members are interested, there are several programs to help them explore biomass options.
Resources: State: UAF Alaska Wood Energy Development Task Group (AWEDTG) pre-feasibility studies), AEA Biomass Program (technical assistance), AEA Renewable Energy Fund (grants). **Federal**: USDA-RD Rural Energy for America Program (small business or agricultural producers).	**Costs: Pre-feasibility**: No cost to the community if funded through AWEDTG grant. Minimum system cost: $100,000. Annual O&M: $500 plus 1 hour labor per day. **(15) Savings:** Depends on size of system and local cost of wood. Burning 50 cords per year in a small cordwood system could displace over 7,000 gallons ($32,900) in diesel fuel per year. At $250 to $300 per cord, wood biomass provides the same amount of heat as diesel fuel at $3.50 per gallon. **(4)**

Diesel Efficiency and Heat Recovery	
High Potential - Diesel currently is used to generate 100% of Ouzinkie's electricity when water levels are too low to use hydro power, but in diesel systems 60% of energy is lost to heat even in the most efficient generators. Measures that improve diesel efficiency and implement heat recovery provide the opportunity for significant fuel savings that will lower the cost of generation and improve the community's ability to compete successfully for new renewable energy grants or financing.	
Issue: Ouzinkie's power plant has a diesel efficiency of 12.6 kWh/gallon. Fuel consumption for the powerhouse is high for the region at 4.8% of generation.	**Opportunity:** Improving diesel efficiency by 10% (to 14.0) would save over 3,700 gallons of fuel per year and $17,600 in avoided fuel costs.
Issue: Adding new renewable energy sources such as wind doesn't make sense unless the rest of the power generation and distribution system is in good condition, the utility is well-managed, heat recovery has been fully implemented, and energy efficiency upgrades have been completed.	**Opportunity**: Balance three phase power to increase diesel efficiency and reliability. Repair aging distribution system to address safety and efficiency issues (replace old wiring, casing around poles, corroded meters, re-sag conductors, etc.). **(14) (57)**
Issue: Currently the utility is charging $0.37 per kWh, while generation costs are $0.52 per kWh.	**Opportunity:** Electric rates should cover fuel and non-fuel expenses. Reducing generation costs through efficiency will improve the economics of the utility.
Issue: It appears that heat recovery has not been implemented at the Ouzinkie power plant. Heat recovery can recover 10-20% of the energy in diesel fuel by providing heat to nearby buildings while providing another source of revenue for the utility. The 2010Alaska Energy Pathway model estimated 824 MMBTU in energy could be captured, but that number has not been updated or verified.	**Opportunity**: Analyze the feasibility of implementing water jacket heat recovery at the power plant. AEA provides feasibility studies for heat recovery systems. Utilities should contact the AEA Heat Recovery Program Manager if they have opportunities to install or expand a heat recovery system.
Issue: Operator proficiency and system maintenance are very important to efficiency. Funders also want to see that diesel systems are well maintained and operating efficiently before funding new renewable generation projects. In the 2012 RPSU study, operator proficiency was rated as unacceptable in the areas of Maintenance Planning and Scheduled Maintenance. All other areas were all rated Acceptable. (8)	**Opportunity**: Improve maintenance planning. Provide all operators with additional training to increase proficiency to Good or Excellent levels in all areas. Send operators to AVTEC in Anchorage for Power Plant Operator training. No cost for instruction, lodging and per diem for the 2-4 week course. The community is responsible for travel and must have an alternate power plant operator in the interim.
Resources: **State**: AEA Powerhouse and Electrical Distribution Upgrades Program, RPSU program, Power Plant Operator Training. **Federal**: Denali Commission Training Fund.	**Costs and Savings:** Distribution system repair: Not known. Cost of replacing rusted meters is customer's responsibility. Heat Recovery: In 2010, capital costs were modeled at $157,000 with annual O&M costs of $22,000 and annual savings of $207,000 **(4)**. AVTEC training: Travel cost to Anchorage.

Emerging Technologies	
Unknown –While early reconnaissance models suggest that Whale Passage near Port Lions, may have the best tidal energy resource in the region, tidal energy resources may also exist in Ouzinkie Narrows.	
Issue: Tidal energy like other ocean power technologies is not yet close to being ready for commercial deployment. Since these technologies are still in R&D, there are competing designs being tested and new developments are occurring regularly.	**Opportunity:** Monitor ongoing research and developments in tidal energy, including the 150 kW pilot project underway near Nikiski, to assess its potential to providing a future economic energy solution for Ouzinkie. Another demonstration project to watch is the larger grid-connected tidal project in the Bay of Fundy near Eastport Maine.
Resources: Emerging Energy Technology Fund	**Cost:** No cost for monitoring developments

Energy Efficiency and Conservation	
High Potential – Since the cheapest kilowatt or gallon of fuel is the one you don't have to buy, there is high potential to save on energy costs by actively promoting additional residential and commercial EE&C and by auditing public buildings and facilities (street lights and water/sewer system) to identify potential savings.	
Residential Energy Efficiency	
Issue: Over 2/3 of the community's housing stock was built before 1980 when energy ratings of 2 or 2-star-plus were typical, with energy costs that are 40% to 50% higher than a 4-star-plus or 5-star home built since 2000. Less than a quarter of these older homes have been weatherized through available programs.	**Opportunity**: Encourage any remaining residents who are income-eligible to weatherize through AHFC's or KIHA's programs. (Owner-occupied homes already weatherized with NAHASDA funding may be able to achieve additional savings through AHFC's Home Energy Rebate program, which typically achieves higher savings rates.)
Issue: No Ouzinkie residents have participated in AHFC's Home Energy Rebate program, which provides higher energy savings (35%) per home compared with weatherization programs in the region (18% savings) and has no income limits, but requires the house to be owner occupied.	**Opportunity**: AHFC's Roving Energy Rater Program will send a home energy rater to a small community if there 3 homeowners sign up for an audit. A community can increase HER participation rates by actively promoting the program and encouraging residents to sign up or helping them to do so. KANA has applied for an EDA grant to help coordinate and promote EE&C in the region.
Resources: State: AFHC Home Energy Rebate, Weatherization, Roving Energy Rater. **Federal**: U.S. HUD NAHASDA Grants through KIHA. **Regional:** EE&C Coordination through KANA (pending grant application)	**Costs: State/federal**: Weatherization: $30,000 per home in rural Alaska (including transportation, logistics, overhead and health and safety measures). Home Energy Rebate: $4,800 (average homeowner rebate). **Local/regional:** Outreach and coordination costs (not known). **Annual Savings**: Energy**:** 1,288 MMBTU. Fuel (gallons): 17,972. Fuel (cost): $43,474.
Non-residential Energy Efficiency	
Issue: Residential and commercial electrical use per customer is slightly lower than average for rural communities in the region, while public facility energy use is slightly above average in Ouzinkie.	**Opportunity**: Maximize community energy savings by applying for a whole village energy retrofit to audit and upgrade community facilities and infrastructure. Individual building audits may be available through AEA or AHFC. Encourage private building owners to apply to AEA's Commercial Building Energy Audit (CBEA) program.

Energy Efficiency and Conservation	
Issue: Before its 2012 audit, the Ouzinkie School used over $57,000 in electricity and $31,000 in fuel oil annually. The AHFC audit identified 14 energy saving measures. Statewide, many public facilities have not made recommended improvements after completing audits despite short payback periods for many measures. KIBSD is in the process of making improvements, especially as repair and replacement needs arise (49).	**Opportunity**: If the school district implements just the most cost-effective measures (those with a savings to investment ratio over 1.0), energy costs can be reduced by nearly $16,000 (16%) with an investment of $118,600 (payback over 10 years). If the district implements just the 6 measures with the shortest payback, it could save $8,000 per year, including 1,250 gallons of fuel, with an investment of $12,100 (combined payback 1.5 years) **(59)**.
Issue: There is no record of an LED street lighting retrofit in Ouzinkie.	**Opportunity**: LED street lighting is highly efficient compared to conventional street lights. Though somewhat capital intensive, it can save up to 75% on energy usage on public outdoor lighting. Financing for street light upgrades may be available through grant and loan programs that include energy efficiency among their guidelines. See *Project Financing* in Vol I.
Resources: **State:** CBEA (commercial enterprises), Alaska DEED Capital Improvements Program (schools). Alaska DCCED Alternative Energy and Conservation Revolving Loan Fund (public and commercial facilities). AHFC Alaska Energy Efficiency Revolving Loan Program (public facilities). **Federal:** USDA RD Rural Energy for America Guaranteed Loan Program (small business), Federal Tax Deduction for Commercial Buildings. DOE-IE START Alaska, other Tribal energy programs.	**Costs:** An investment of $6 to 7 per square foot is typically needed to achieve a 30% energy savings, resulting in payback periods of 5-6 years **(15)**. **Savings**: Expect 10-15% annual savings on public facilities EE&C improvements from making only behavioral changes, 15-25% savings if making all the most cost-effective changes, and 25-35% savings if all recommended energy improvements are completed. **Street Lighting**: Estimate $1,000 per light. Communities with populations of 100 to 250 have achieved annual savings of $2,600 (6,700 kWh) with an investment ranging from $10,000 to $30,000, and average payback of 10 years [ARIS data].
Issue: Sanitation systems are one of the single largest energy uses in rural communities, accounting for 10% to 38% of community energy use, depending on system type and climate zone.	**Opportunity**: Audit water and sewer system to determine energy use and EE&C opportunities, including the potential for heat recovery or solar thermal installation.
Resources: Tribal: ANTHC. **Federal**: EDA	**Costs:** Not known. **Savings:** $10,000 per year have been saved through sanitation systems EE&C in arctic communities. Savings may be lower in Kodiak region due to milder climate. A 10% reduction in energy use in Ouzinkie would save 106 MMBTU per year; 1,045 gallons of fuel oil; 5,200 kWh; and $4,600 in avoided fuel costs based on modeling.

Fossil Fuels
Low Potential – Coal, oil and gas are not known to occur in large quantities in the Kodiak region. Coal beds on Kodiak Island are believed to be thin and likely not an economic resource. The geology also makes it unlikely that commercial quantities of conventional or unconventional oil and gas resources will be discovered. **(16)**

Geothermal
Low Potential – There are no known geothermal resources in Kodiak region **(16)**. Ground source heat pumps have high capital costs and are typically economic only where heating costs are high and electric rates low. Heat pumps could become an option in future if an intertie or other energy project succeeds in bringing down electricity rates.

Hydroelectric	
High Potential —The 125 kW hydro system at Mahoona Lake meets half of Ouzinkie's energy needs when it is operational, but the timber dam is rotting and the reservoir has been drained pending repair or replacement. The community is in the first phase of a project to construct a new dam with 25% more water capacity. Its goal is to produce a minimum of 50 kW year-round. **(57) (60)**	
Issue: Because the lake also provides the town's water supply, the hydro plant is required to go offline when water levels are low, typically in late fall but sometimes in later summer and winter as well.	**Opportunity:** There is an opportunity to generate a more hydropower with a new dam structure **(60)**. The community plans to apply for a grant to fund the design and construct an upgraded hydro plant, including new penstock, supply line and modern turbine. The community would also like to conduct a hydro reconnaissance study to look at additional hydro sites **(57)**.
Resources: State: AEA Hydroelectric program, Renewable Energy Fund, Power Project Loans, Community Development Block Grants, ADF&G Division of Habitat. **Federal**: Economic Development Administration grants, USDA Rural Development grants, Indian Development Block Grants. **Private**: Partnering with a for-profit entity to take advantage of new market tax credits.	**Costs:** Phase I dam reconstruction: Legislature provided $1.8-$2.1 million for demolition and construction of new dam. $50,000 will be needed to complete the project **(57)**. Phase II hydro plant design and construction: Not known. Reconnaissance study: $75,000. **Savings**: Not known.

Intertie	
Medium Potential – A tie-in to the Kodiak Electric Association grid has been explored at the conceptual level by KEA and the Ouzinkie community and an initial feasibility study completed. The majority of the route would be overland, but a 1 to 1.4 mile submarine cable would span the channel between Kodiak and Spruce Islands. The intertie would give residents and businesses in Ouzkinkie access to an abundant supply of renewably-generated electricity at a potential cost savings to non-PCE electric customers in Ouzinkie. The community would continue to operate and maintain its distribution system, which is currently in need of repair. The next step is bathymetric surveys and marine geophysical studies to refine and verify the submarine feasibility by locating satisfactory sea bottom conditions. The project was recommended for full funding by AEA in 2012, pending a letter of support from KEA, but was not ranked high enough to make the cut off for that year's legislative appropriation. Timeline: 2 to 3 years for permitting and construction.	

Issue: The City of Ouzinkie, which owns and operates the current electrical utility, is concerned about the loss of local jobs in electrical generation, and in the loss of income from electric sales which is currently used to subsidize other public utilities (water, sewer and landfill fees). Ouzinkie currently has both electrical and hydro power generation but of limited capacity and reliability. According to its RE Fund application, the current electrical system is inadequate to support additional community growth, expansion or electrical consumption. (57)[REF VI 928]	**Opportunities**: Commercial and industrial utility customers who are not eligible for PCE-subsidized rates currently pay $0.37/kWh for electricity. The ability to provide lower rates and a reliable supply of electricity to business and industry has the potential to spur economic growth in Ouzinkie and pave the way for the local seafood processing facility with freezing and holding capacity that the community has been working towards. **(61)**
Issue: With an average load of 100kw, the small size of the community load challenges the economics of any electrical generation project. The utility is in the process of rebuilding its hydroelectric infrastructure while also exploring wind and intertie options. The community needs to decide which of these energy solutions it wants to pursue. The intertie project is strongly supported by Ouzinkie Native Corporation, which partially funded the initial feasibility study, while the City has taken the lead on hydro upgrades.	**Opportunity**: Ouzinkie has the benefit of having several good energy pathways open to it. Engaging in community-wide strategic planning may help to develop a consensus on which energy resource has the best potential to reduce costs, meet current and future demand, increase reliability, and reduce dependence on fossil fuels. Since the community includes a federally recognized tribe, consider applying to the U.S. DOI Office of Indian Energy for a [program that provides 40 hours of strategic planning]
Resources: **State**: Power Project Loans, Community Development Block Grants. **Federal**: Economic Development Administration grants, USDA Rural Development grants, Indian Development Block Grants. **Private**: Partnering with a for-profit entity.	**Costs:** Bathymetric survey: $431,400. Capital costs: $7-9 million. O&M: Not known. **Savings**: Not known. Savings would primarily go to non-PCE users in Ouzinkie since the PCE-subsidized rate is currently lower than KEA's residential rate. Residents could see overall utility costs go up since, according to the Ouzinkie's electric utility manager, local electric sales currently keep water, sewer and landfill rates artificially low. **(57) (31)**

Solar	
Medium Potential – Solar does not offer a utility-scale solution in Alaska, but solar PV and solar thermal projects can provide relief for individual homes and facilities, especially those off the grid or that have high summer electric usage. KIHA installed solar hot water heaters in 7 homes in Ouzinkie. The project was grant funded and no data is yet available on whether this provides a cost-effective heating solution for additional homes in the region.	
Issue: Kodiak receives an average of 3 to 3.5 kWh/m^2/day of solar radiation annually, with most coming in April to August. A 4 kW fixed-tilt solar PV array on a building in Kodiak can produce 3,373 kWh of AC power per year if the solar panels are kept free of snow.	**Opportunity:** At Ouzinkie's non-PCE rate of $0.37/kWh, that is the equivalent of $1,248 of electricity purchased from the utility.

Issue: If more households or businesses meet some of their electrical needs through self-generation, the challenges of integrating new utility-scale renewable resources into a small load intensify.	**Opportunity**: Using solar technologies to reduce space and hot water heating costs may be more economical than using solar energy to generate electricity and will not reduce the utility's electric load. However, these systems are significantly more complex to set up and maintain than PV arrays and so having trained and knowledgeable operators is important.
Resources: Federal: NREL (funding, technical support), PVWatts Viewer (calculates potential solar energy production and cost), EPA IGAP, DOE-IE Tribal energy programs. **Other**: Alaskasun.org **(**information, contractors and supplies)	**Costs:** Solar PV capital costs: $3 to $10 per watt depending on who does the installation, making the installed cost of a 4kW system $12,000 to $40,000. Costs for a system off the grid need to include the cost of battery storage. **Savings**: Not known.

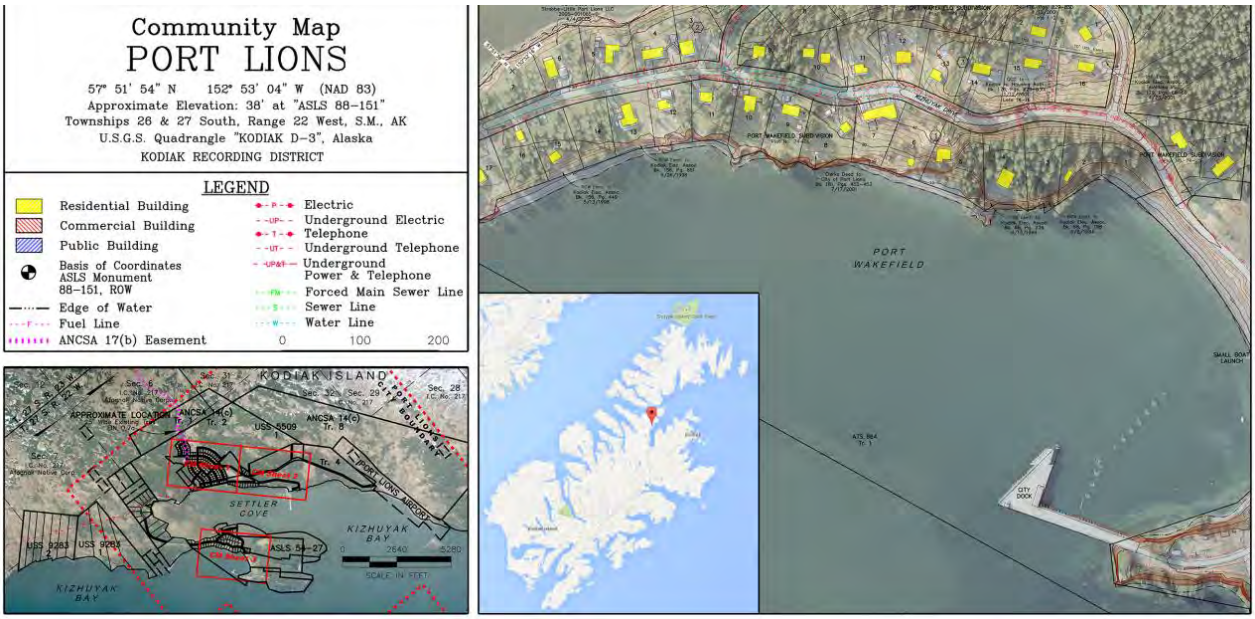
Transportation Infrastructure
Low Potential – With Ouzinkie's new dock, there are no issues with barge delivery of bulk fuel, and the community has not needed to bring fuel in by air. **(57)**

Wind	
Medium Potential –Exploring wind energy feasibility is a top community priority in Ouzinkie. Wind was also one of three renewable resources recommended for Ouzinkie in the 2010 Alaska Energy Pathway plan. While previous wind models have estimated a class 5 wind regime 3 miles east of town, nearer sites may be as low as class 1, so more reconnaissance work is needed. There are also technical challenges in integrating wind in communities with relatively small electric loads.	
Issue: Ouzinkie submitted an RE Fund application in 2009 for a wind pre-feasibility study. The project was not recommended for funding by AEA because the site was believed to be a class 1 wind resource. The 80 ft. tall trees surrounding the site and lack of storage capacity were also notes as factors that would make a project more challenging.	**Opportunities**: It may be worthwhile investigating wind resource in clearing NE of town [or] on other side of the lake. A 30-meter Met tower should be set up and a minimum of a year's worth of data collected. It may also be possible to put sensors on light poles near the dock to determine wind class. Before putting in another wind study application, work directly with AEA staff to design the best approach. **(28)**
Issue: Average electric loads in Ouzinkie are 100 kW. Ideally, a wind turbine should be sized so one generator can be shut down completely when the wind is blowing, while another remains on to keep the grid open, but this is hard to achieve with small loads. Operating a generator at low capacity reduces fuel efficiency offsetting the savings. Excess electrical energy can be stored (in batteries or high temperature bricks) or dispatched as a secondary load to an electric boiler or heat recovery loop, but these increase the cost and complexity of the system.	**Opportunity**: A battery storage system is recommended to integrate wind into a diesel system with a very small load. Statewide there is also interest in using wind output for heating, which is more tolerant of power swings and easier to store. Wind to heat projects also have challenging economics so feasibility work is needed.
Issue: Ouzinkie's gensets will need to be to be modified or replaced to enable integration with an intermittent renewable resource like wind.	**Opportunity**: As part of any feasibility work the diesel generators should be evaluated by an engineer and recommendations made for wind integration.

Issue: Ouzinkie wants to maximize its renewable capacity and is interested in an assessment of all options they have available. (57)	**Opportunity:** Apply for an RE Fund grant or other funding to review all renewable energy options.
Resources: **State**: AEA Anemometer Loan Program, Renewable Energy Fund, Power Project Loans, Community Development Block Grants. **Federal**: Economic Development Administration grants, USDA Rural Development grants, Indian Development Block Grants. **Private**: Partnering with a for-profit entity to take advantage of new market tax credits.	**Costs:** Wind reconnaissance study: $60,000. Broader renewable energy screening study: $125,000. **Savings**: Not known.

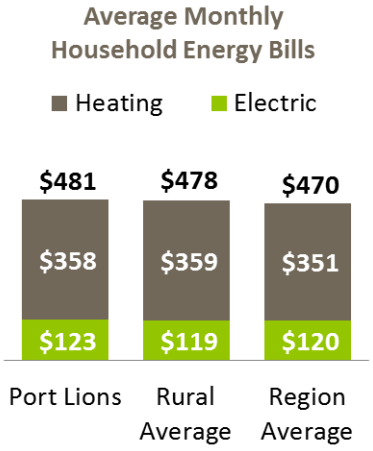
Community and Regional Plans		
Year	**Report Title (Author)**	**Community-specific, Energy-related Recommendations**
2013	Kodiak Rural Regional Comprehensive Economic Development Strategy (Kodiak Area Native Association)	1. Dock/industrial area construction and development 2. City dock and ferry terminal replacement. 3. Small boat harbor replacement – completed. 4. Install additional alternative energy sources to current hydroelectric to replace back-up diesel generation.
2009	Kodiak Island Borough Regional Energy Plan (Kodiak Island Borough Community Development Department)	1. Power lines and transformers require replacement. 2. Wind metering tower needs to be replaced to continue studies. 3. Participate in feasibility study with the Kodiak Electric Authority vs. local generation.
2008	Kodiak Island Borough Comprehensive Plan Update (Kodiak Island Borough)	1. Replace old wooden dock with one that could support fishing, tourism, fish processing, and the Alaska Marine Highway. 2. Explore opportunities for alternative energy, such as wind. 3. Access roads to the boat harbor and a boat ramp are needed. 4. Local road system needs to be upgraded and expanded. 5. Build a new airstrip developed in accordance with existing project design. 6. Increase bulk fuel storage to provide storage for #2 fuel oil. 7. Determine the feasibility of Terror Lake Power Intertie to Ouzinkie. 8. Improve and expand hydroelectric facility. 9. Explore alternative sources of bulk fuel such as a fuel buying cooperative and the establishment of a bulk fuel company. 10. Complete an alternative energy feasibility study by 2011.
2003 Update to 2001	Kodiak Region Comprehensive Economic Development Strategy - Revised (Kodiak Chamber of Commerce)	1. Power generation improvement. 2. Road development. 3. Road access improvement to hydroelectric station.
1984	Ouzinkie Comprehensive Development Plan, City of Ouzinkie, Kodiak Island Borough (Norgaard Consultants)	1. Construct a breakwater facility in the harbor with associated mooring facilities for local and transient fishing vessels. 2. Actively solicit the development of a mini-freight ferry service to/from Kodiak for both freight and passenger service. 3. Develop off/on-loading ramp for barges, other freight carriers. 4. Develop a fuel delivery system for local island residents. 5. Maintain and expand the city's utility system as necessary to provide services to new housing development. 6. The existing electrical distribution system needs repair, and in many areas replacement. 7. Utilizing the existing diesel generation system as back-up, construction of a 78-kilowatt hydroelectric plant at Katmai Creek.

PORT LIONS

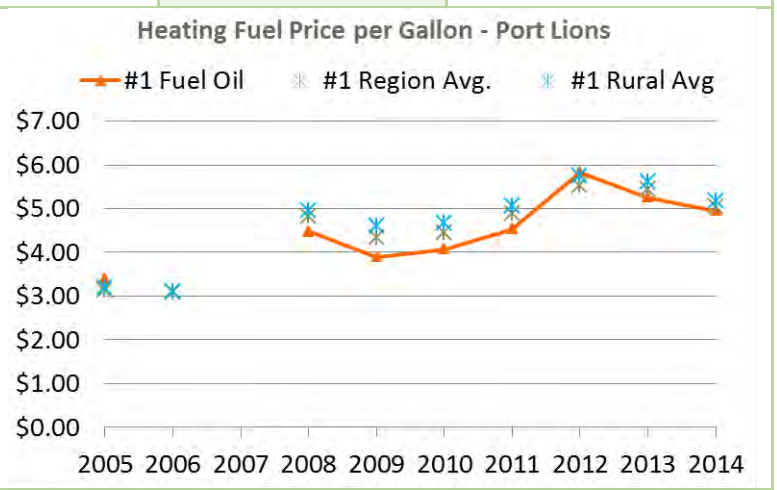


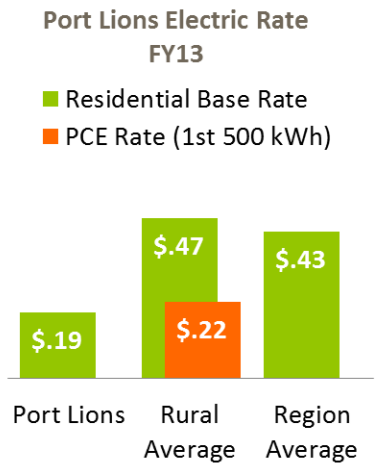
Community Vision: We are a small, healthy rural community that is a safe place to live where our children enjoy growing, learning and want to stay. We enjoy the peace and challenges of our beautiful, clean environment, while maintaining a subsistence lifestyle, balanced with the modern changing world. We take pride in our history and cultures. We have sound economic infrastructures, resources and education. We are a community where families and friendships flourish through caring, trust and mutual respect.		
Community Energy Priorities[1]	Priorities	Concerns
	Weatherization of public buildings is top EE priority	- Economic Development, especially enterprise that serve the community (such as a store or anything related to fisheries - Telecommunications and technology - Environmental issues, particularly the scrap metal situation - Rural K-12 Education
	Replace exterior lights on public and private buildings with LEDs	
Local Stakeholders Groups	City of Port Lions	
	Native Village of Port Lions	
	Kodiak Electric Association	
Energy Champions[1]	Kathryn Adkins, City Clerk & Grant Administrator, City of Port Lions; Dorinda Kewan, Grants Coordinator, Native Village of Port Lions	
Sources: (20) (2) (62). Notes: 1/Based on Phase II input.		

TOTAL ENERGY USE			
Electrical Generation	None (Connected to KEA grid)	**Sold**: 1,109 MWh	**Residential**: 135 **Public Facilities**: 15 **Commercial**: 49
Annual Fuel Use	**Electric:** NA	**Space Heating**: 97,391 gals. (4)	**Transportation**: 26,049 gals. (22)
Fuel Price	**Electric**: NA	**Heating**: $4.95/gal. #1 Oil (Jan. 2014) (5)	**Transportation**: Not Known
Electric Utility	Kodiak Electric Association	PCE Status	Ineligible

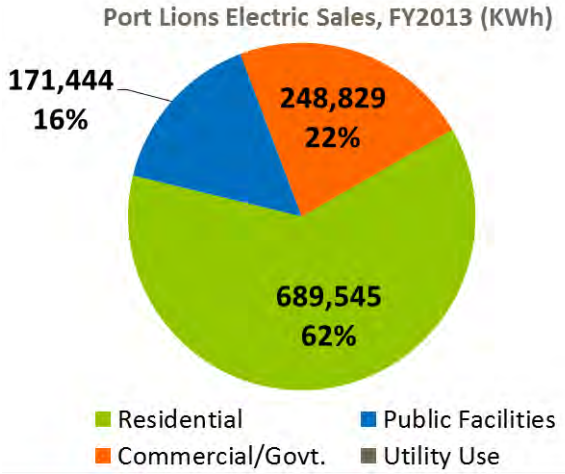


Heating Fuel Cost (5)





Electric Sales by Customer Type

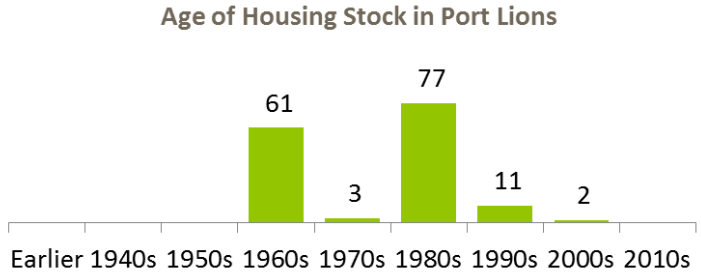


Sources (except as noted): **(20) (2) (62) (31)**.

ENERGY EFFICIENCY AND CONSERVATION

Residential

Occupied Housing Units	Housing Type, including Vacant	Average Home Size (est.)[1]	Avg. HH Size / Overcrowding	Median HH Income	Energy Cost as a % of Income
94	150 Single Family, 4 Multi	1,701 sf	2.4/ No	$95,259	6%

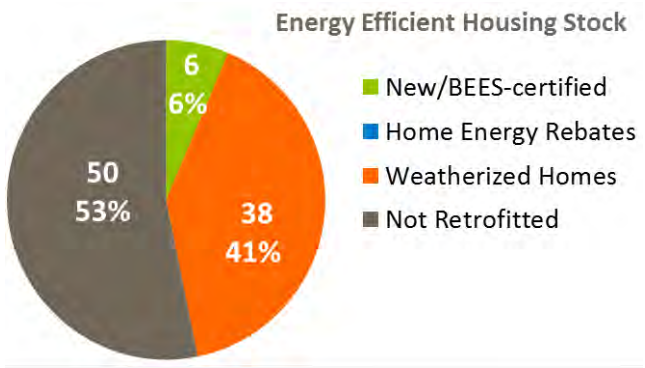


Estimate Annual Energy Use per Home	Average Annual Home Energy Bill
185 MMBTU[1]	$5,776

Note: Older homes are typically less energy-efficient than newer homes, due to improvements in building technology and energy efficiency over time.

Annual Home Energy Savings Achieved	Additional Annual Home Energy Savings Opportunity	Percent of Residential EE&C Work Remaining
1,370 MMBTU 9,840 gals. $48,707	2,503 MMBTU 17,972 gals. $88,962	53%

Model assumptions: Average energy savings for region based on 2008-13 ARIS data (35% HER, 18% AHFC weatherization projects). Retail fuel cost: $4.95/gal.



Non-residential

No. of Public/ Commercial Buildings[2]	Types of Non-residential Buildings	Est. Annual Energy Use per Building[3]	Public or Commercial Building Audits	Non-residential EE&C Measures Identified	Non-residential EE&C Measures Implemented
64	See Appendix B	1,178 MMBTU	City Office Building	Interior Lighting Upgrades	Not Known

Street Light Number	Street Lighting Type	LED Street Lighting Upgrade	Street Lighting Remaining Opportunity	Estimated Cost of LED Street Light Retrofit[4]	LED Street Lighting Annual Energy Savings
30	LED	Completed in 2010	0%	$17,700 plus installation & maintenance	$1,642

Water & Sewer System Type / No. of Homes Served	Water and Sewer Rates	Estimated Annual Water & Sewer Energy Use[1]	Sanitation System Energy Audit Performed	Estimated Cost of Water & Sewer EE&C Upgrades	Estimated Annual Water & Sewer Energy Savings[5]
Piped & Pumped 100 Homes	Not Known	966 MMBTU 5,777 gals. 47,420 kWh	No. Sanitation system built/ upgraded in 2008	Not Known	97 MMBTU 578 gals. $3,761

Sources: (62) (63). **Notes**: 1/ Based on ARIS data for region. 2/ Based on number of electric rate payers. 3/ Based on Energy End-Use Study and 2013 Alaska Housing Assessment data (11) (12). 4/ Actual cost. 5/ Assumes 10% savings on fuel and electric.

BULK FUEL			
Capacity	**Kizhuyak Oil Sales:** 84,000 gallon total capacity. **KEA:** 1,100 gallons	Fuel Purchase	Purchase from Kizhuyak Oil Sales.
Bulk Fuel Upgrade	Completed 2006	Vendors	North Pacific & Petro Marine Services
By Barge	Fuel is delivered to the Port Lions dock by tug-assisted barge 2-3 times per year; fuel is transported to the tank farm via fuel lines.		
Local Delivery	Kizhuyak Oil Sales, a subsidiary of the Native Village of Port Lions, sells #1 fuel oil, #2 fuel oil and gasoline to all in Port Lions and marine vessels **(62)**. Fuel is also moved from the central facility to the school. Sale of #2 fuel oil will cease.		
Cooperative Purchase	No, community interest has not been expressed in bulk fuel ordering. Port Lions burns significant amounts of heating oil for heat but with connection to KEA grid amount uses is not relatively high. Also, there have been moves to switch from electric water heaters to lower fuel use **(62)**.		
Sources (unless otherwise noted): **(64)**			

BIOMASS

Medium Potential – Port Lions area is dominated by Sitka spruce. Many residents are also shareholders of Afognak Native Corporation, which owns vast acreage on heavily forested Afognak Island. Wood is one of two energy pathways identified for Port Lions in the 2010 Alaska Energy Pathway report (the other being wind). There are no fish processors in Port Lions that would be a source of fish oil for biofuel and no class I landfill as a source of solid waste. **(4) (13) (65)**

Issue: Port Lions residents have access to spruce forests near the community and on traditional lands on Afognak Island. Afognak Native Corporation has an active forestry program that balances timber harvest with recreation and subsistence use. Sufficient biomass may exist to sustain a modestly scaled project to heat one or more community buildings.	**Opportunity:** Dry spruce can provide 19-22 MMBTU per cord. The UAF Alaska Wood Energy Development Task Group has an easy application process to request funding for a reconnaissance study of forest resources available to the community. The study should also look at logging slash and un-merchantable wood from Afognak Island operations.
Issue: Wood biomass projects have the added benefit of creating local jobs as wood cutters and boiler operators, but they require strong community leadership and interest to succeed. To date, biomass is not one of the renewable energy technologies the community has expressed interest in.	**Opportunity:** A community biomass project with strong local champions could provide both skilled and unskilled jobs, while reducing heating costs and diesel dependence. If community members are interested, there are several programs to help them explore biomass options.
Resources: State: UAF Alaska Wood Energy Development Task Group (AWEDTG) pre-feasibility studies), AEA Biomass Program (technical assistance), AEA Renewable Energy Fund (grants). **Federal**: USDA-RD Rural Energy for America Program (small business or agricultural producers).	**Costs:** Pre-feasibility: No cost to the community if funded through AWEDTG grant. Minimum system cost: $100,000. Annual O&M: $500 plus 1 hour labor per day. **(15) Savings:** Depends on size of system and local cost of wood. Burning 50 cords per year in a small cordwood system could displace over 7,000 gallons ($32,900) in diesel fuel per year. At $250 to $300 per cord, wood biomass provides the same amount of heat as diesel fuel at $3.50 per gallon. **(4)**

Emerging Technologies	
Unknown –Early reconnaissance models suggest that Whale Passage near Port Lions may have the best tidal energy resource in the region. This may provide a future renewable energy solution for Port Lions and the Kodiak grid, but economic feasibility cannot be determined until the technology matures.	
Issue: Tidal energy like other ocean power technologies is not yet close to being ready for commercial deployment. Since these technologies are still in R&D, there are competing designs being tested and new developments are occurring regularly.	**Opportunity:** Monitor ongoing research and developments in tidal energy, including the 150 kW pilot Cook Inlet Tidal Energy Project near Nikiski and the grid-connected demonstration project in the Bay of Fundy in eastern Maine. Both are testing devices by Ocean Renewable Power Company (OPRC).
Resources: Emerging Energy Technology Fund	**Cost:** No cost for monitoring developments

ENERGY EFFICIENCY AND CONSERVATION	
High Potential – The cheapest kilowatt or gallon of fuel is the one you don't have to buy. There is high potential to save on space heating costs and lower electric bills by actively promoting additional residential and commercial EE&C and by having public buildings and facilities, including the water and sewer system, audited to identify potential savings.	
Issue: Nearly 90% of the community's housing stock dates from the 1960s and 1980s. Housing of that era in the region typically achieves 2-star and 3-star energy ratings with costs that are 45-50% higher than a 5-star home built since 2000. Fewer than half of these older homes have been weatherized.	**Opportunity**: Encourage remaining residents who are income-eligible to weatherize through AHFC's or KIHA's Wx programs.
Issue: If all income-eligible residents have taken advantage of weatherization programs, then the remaining residential EE&C opportunity is all from AHFC's Home Energy Rebate program, which has no income limits but requires the house to be owner occupied. To date, no Port Lions residents have participated in the HER program, which has provided higher energy savings (35%) per home compared with weatherization programs in the region (18% savings). Almost all savings are in heating, so increased participation will decrease bulk fuel costs and diesel dependence.	**Opportunity**: A community can increase HER participation rates by actively promoting the program and encouraging residents to sign up or helping them to do so. AHFC's Roving Energy Rater Program will send a home energy rater to a small community if there 3 homeowners sign up for an audit. KANA has applied for an EDA grant to help coordinate and promote EE&C in the region. Owner-occupied homes already weatherized with NAHASDA funding may still benefit from the HER program, which typically achieves greater energy savings rates. Homes weatherized with AHFC funds are not eligible for a home energy rebate.
Resources: State: AFHC Home Energy Rebate, Weatherization, Roving Energy Rater. **Federal**: U.S. HUD NAHASDA Grants through KIHA. **Regional:** EE&C Coordination through KANA (pending grant application)	**Costs: State/federal**: Weatherization: $30,000 per home in rural Alaska (including transportation, logistics, overhead and health and safety measures). Home Energy Rebate: $4,800 (average homeowner rebate). **Local/regional:** Outreach and coordination costs (not known). **Annual Savings**: Energy**:** 2,503 MMBTU. Fuel (gallons): 17,972. Fuel (cost): $88,165.

ENERGY EFFICIENCY AND CONSERVATION	
Issue: Port Lions has already undertaken efforts to improve energy efficiency and conservation by replacing all street lights with LEDs and completing lighting retrofits in its city offices. There is opportunity for more savings by having other public buildings audited and promoting commercial EE&C audits for local businesses.	**Opportunity:** There is significant opportunity for savings from additional retrofits to city offices and to other community buildings, especially upgrades to the building envelope, ventilation, mechanical systems, and any refrigeration. The community can apply for audits through AFHC's Commercial Energy Audit program and encourage business owners to apply to AEA's Commercial Building Energy Audit (CBEA) program. EE&C paybacks are generally short enough to make upgrades worth pursuing even if funding only covers audits and not upgrades.
Resources: **AEA:** CEA (commercial enterprises). **Alaska DEED**: Capital Improvements Program (schools). **Alaska DCCED:** Alternative Energy and Conservation Revolving Loan Fund (public and commercial facilities). **AHFC** Alaska Energy Efficiency Revolving Loan Program (public facilities). **USDA** RD Rural Energy for America Guaranteed Loan Program (small business), Federal Tax Deduction for Commercial Buildings.	**Costs and Savings: Public and commercial buildings**: An investment of $6 to 7 per square foot is typically needed to achieve a 30% energy savings, resulting in payback periods of 5-6 years **(15)**.
Issue: Heating at the water and sewer facilities is by Toyo stove. The system is the largest electrical user of the city's facilities. (62)	**Opportunity:** Audit water and sewer system to determine energy use and EE&C opportunities, including the potential for more efficient heating systems and electricity conservation**.**
Resources: Tribal: ANTHC. **Federal**: EDA	**Costs:** Not known.

ENERGY EFFICIENCY AND CONSERVATION

FOSSIL FUELS

Low Potential – Coal, oil and gas are not known to occur in large quantities in the Kodiak region. Coal beds on Kodiak Island are believed to be thin and likely not an economic resource. The geology also makes it unlikely that commercial quantities of conventional or unconventional oil and gas resources will be discovered. **(16)**

GEOTHERMAL

Medium Potential – There are no known geothermal resources in Kodiak region **(16)**. However, air and ground source heat pumps may be economically feasible in the city of Port Lions.

Issue: Ground source heat pumps (GSHP) have high capital costs and are typically economic only where fuel costs are high and electric rates low. Air source heat pumps (ASHP) have much lower capital costs but because they also require electricity to operate, they may still be uneconomic if electrical costs are high or volatile.	**Opportunity:** With a relatively moderate climate, stable electricity rates, and high heating oil costs, Port Lions may be well suited for ground or air source heat pumps. KEA could look at offering incentives used by utilities in Southeast Alaska to encourage utility customers to install heat pumps if they prove feasible.
Resources: State: Research on heat pump design and costs is ongoing at UAF's Alaska Center for Energy and Power (ACEP). The Cold Climate Housing Research Center, also at UAF, is conducting research and demonstration projects on both types of heat pumps.	Air Source Heat Pumps: **Capital cost**: $6,000. **Savings**: $600 to $2,700 annually, based on model for 3 bedroom home in Kodiak **(43)**. Ground Source Heat Pumps: **Capital cost:** $29,300. **Savings:** $1,600 to $2,900 annually based on a 1,700 sf home in Juneau with lower electricity and fuel costs than Kodiak **(44)**.

HYDROELECTRIC

Low Potential: Hydro is listed as an energy pathway for Port Lions in the 2010 Alaska Energy Pathway report. Over 80% of the community's electricity is already generated by hydropower at KEA's Terror Lake facility. KEA plans to add additional hydro capacity over the next decade. No plans currently exist to develop hydro resources in the immediate Port Lions area.

Solar

Medium Potential – Solar does not offer a utility-scale solution in Alaska, but solar PV and solar thermal projects can provide relief for individual homes and facilities, especially those off the grid or that have high summer electric usage. KIHA installed solar hot water heaters in 4 homes in Port Lions. The project was grant funded and no data is yet available on whether this provides a cost-effective heating solution for additional homes in the region.

Issue: Kodiak receives an average of 3 to 3.5 kWh/m^2/day of solar radiation annually, with most coming in April to August. While this is primarily a low-level, seasonal resource, it can provide savings to for	**Opportunity:** A 4 kW fixed-tilt solar PV array on a building can produce 3,373 kWh of AC power per year if the solar panels are kept free of snow. At Port Lions' rate of $0.19/kWh, that is the equivalent of $641 of power purchased from the utility.
Resources: Federal: NREL (funding, technical support), PVWatts Viewer (calculates potential solar energy production and cost), EPA IGAP, DOE-IE Tribal energy programs. **Other**: Alaskasun.org **(**information, contractors and supplies)	**Costs:** $3 to $10 per watt depending on who does the installation, making the installed cost of a 4kW system $12,000 to $40,000. Costs for a system off the grid need to include the cost of battery storage. **Savings**: Not known.

TRANSPORTATION INFRASTRUCTURE
Low Potential - The transportation component of barged fuel prices can be reduced by investing in marine infrastructure that allows fuel to be off-loaded safely and efficiently. Port Lions has had recent dock and harbor upgrades and there are no known issues with offloading fuel. The community is connected to the KEA grid, which reduces the volume of bulk fuel it is necessary to import. Some residents are also switching to electricity for heating, furthering lowering fuel use **(62)**.

Wind	
Unknown – The 2010 Alaska Energy Pathway identified wind as a resource with development potential in Port Lions. The wind resource on Mount Elison is reported to be class 7.	
Issue: With an estimated wind class of 7, there is a potential for damaging winds on the Mount Elison. The challenge for this project may be finding a turbine that can survive the potential harsh environment, while still being sized appropriately.	**Opportunity**: If the community has interest in pursuing a wind project, additional data on the wind resource must be collected, one of the first steps is to collect one year of wind data using a wind anemometer or "met" tower.
Issue: The Alaska Energy Pathway report provided information on a wind system with technology for electric dump load controlling. Installing technology for electric dump load controlling or battery storage of electricity produced with a wind system will likely need to be investigated with KEA. The estimated savings (which have not been verified or updated) was negative.	**Opportunity:** If met tower data shows potential and community interest is expressed, more analysis would be needed before proceeding and a discussion of how to integrate wind power from Port Lions into the grid would need to take place with KEA.
Resources: **State**: AEA Anemometer Loan Program, Renewable Energy Fund, Power Project Loans, Community Development Block Grants. **Federal**: Economic Development Administration grants, USDA Rural Development grants, Indian Development Block Grants. **Private**: Partnering with a for-profit entity to take advantage of new market tax credits.	**Costs**: Feasibility study: $70,000.

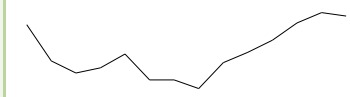
Community and Regional Plans		
Year	Report Title (Author)	Community-specific, Energy-related Recommendations
2009	Kodiak Island Borough Regional Energy Plan (Kodiak Island Borough Community Development Department)	1. Community will develop long-term energy plan with grant monies. 2. School boiler needs to be replaced. 3. Located near Whale Pass, which has very high tidal changes and could in the long-term supply power archipelago wide.
2009	City Dock & Ferry Terminal Repairs Technical Report (Denali Commission)	1. Dock is in poor condition with inadequate lateral stabilization and a significantly reduced weight capacity.
2008	Kodiak Island Borough Community Plan Update (Kodiak Island Borough Community Development Department)	1. Establish better transportation facilities including a new ferry dock and improved boat harbor and complete planned airstrip improvements. 2. Need for a hydroelectric or other alternative energy facility downtown. 3. Upgrade existing fuel tank farm to bring current fuel tank farm into regulatory compliance. 4. Establish collaborative or cooperative bulk fuel purchases with other Kodiak Island rural communities.
2003	Port Lions Comprehensive Community Plan (Kodiak Island Housing Authority & Alisha Drabek)	1. Build a full boat harbor, dock repair and maintenance.
2003 Update to 2001	Kodiak Region Comprehensive Economic Development Strategy - Revised (Kodiak Chamber of Commerce)	1. Public dock facility.
1997 Update to 1982	Port Lions Comprehensive Development Plan (Kodiak Island Borough Community Development Department)	1. Industrial development on the Peregrebni Peninsula will require several thousand more feet of utility lines.

APPENDIX A

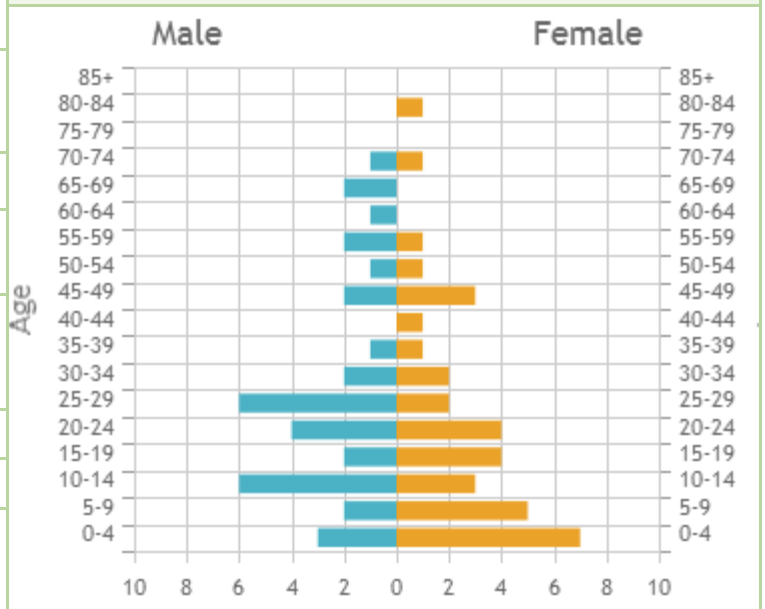
BACKGROUND INFORMATION

AKHIOK

GENERAL INFORMATION			
Location	Southern end of Kodiak Island at Alitak Bay. It lies 80 miles southwest of the City of Kodiak and 340 miles southwest of Anchorage.		
City Government	2nd Class; Incorporated 1974	Tribal Government	Native Village of Akhiok and Kagyuak Tribal Council (federally recognized)
Taxes	None		

DEMOGRAPHICS		
2000 Census	2010 Census	2013 (est.)
80	71	85
Change since 2000		
Percent Change	6.25%	
Avg. Annual Growth	0.45%	
Historic Trend	Steady growth past 6 years reversing decline since 2000. Summer population up 10-15.	
Local Prediction	None	
Median Age (9)	30 years (2010)	
Race/Ethnicity (9)	50.7% Alaska Native / 38.0% Two or more races / 8.5% White / 1.4% Black / 1.4% Asian	

Age by Sex



ECONOMY			
Overview	Public sector employment, commercial fishing, other seasonal work provide cash, with some tourism (on sport fishing and hunting). (50) (4)	Subsistence Resources	Almost all residents depend heavily on subsistence. Salmon, crab, shrimp, clams, ducks, seal, deer, rabbit and bear are utilized. **(4)**
Employers	Main employers: City of Akhiok, KANA, KIBSD (66)	Business Licenses	3
Total Wages	$592,842 (10)	Commercial Fishing	5 permits
Median Household Income[1]	$17,500 (10)	Seafood Processors	Ocean Beauty Seafoods (Alitak)
Residents over 16	49 (10)	Residents Employed	32 (65%)
Employed year-round	18 (56%) (10)	Below Poverty	20.5%
Sources (except as noted): **(10)**			

EDUCATION			
School	Grades K-12		
Students	22 (2013-14)	**Teachers**	2 (2013-14)

LAND	
Land Ownership	Akhiok-Kaguyak Native Corporation (surface), Koniag Inc. Native Corporation (sub-surface), land holdings within Kodiak National Wildlife Refuge is administered as federal land. Airstrip (ADOT&PF); School (KIB)
Topography	Upland and tidelands area on the west shore of Akhiok Bay. Surrounding terrain consists mostly of low hills, tundra-like valleys and flat land.
Vegetation and Soils	Dominated by moist tundra. There are few tall brush areas and trees, although some stands of alder are present. The dominant vegetation includes tall grasses, fireweed, horse-tail, yarrow, sedges, mosses, ferns, lichens, alder, and dwarf birch.
Environmental Issues	Earthquakes represent a major potential hazard for the community as well as flooding due to land settling and seismic sea waves. Major coastal erosion and shoreline damage has been reported from storms and sea-wave activity.
Sources: **(13)**	

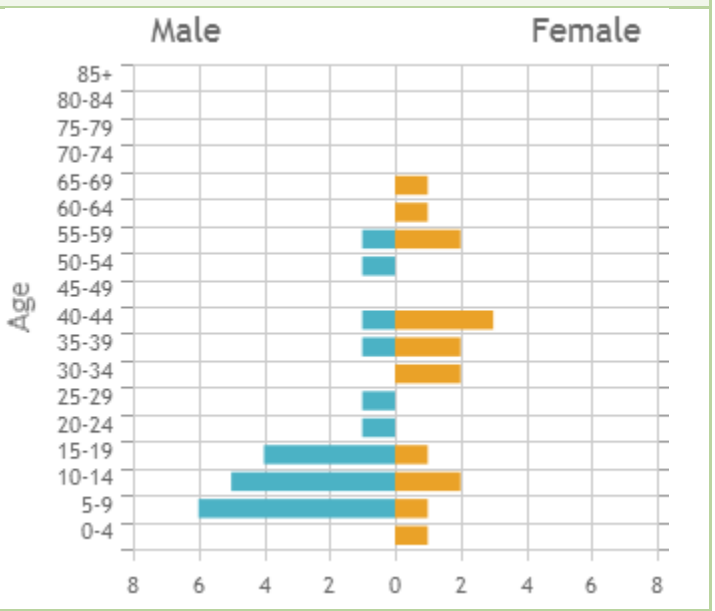
TRANSPORTATION			
Road	No connector roads. Approximately 2 miles of roads in the community connect homes, other buildings and the landfill to each other. Roads are gravel, in good condition.		
Marine	No deep sea dock or boat harbor. There is no regular barge or other water freight service. However, at least one company transports loads by landing craft as needed.		
Aviation	3,120-foot runway south of town. No crosswind runway or tower services exist and service is frequently unavailable for extended periods of time due to severe weather. The facility can be used by wheeled general aviation and amphibious float-planes.		
Vehicles	Light vehicles: 3 (1998)	Aircraft	**NA**
	Heavy equipment: 2 (1998)	Boats	**NA**
Sources (except as noted): **(13)**			

KARLUK

GENERAL INFORMATION			
Location	West coast of Kodiak Island, 88 air miles southwest of Kodiak, at the mouth of the Karluk River.		
City Government	Unincorporated	Tribal Government	Native Village of Karluk (federally recognized)
Taxes	None		

DEMOGRAPHICS		
2000 Census	2010 Census	2013 (est.)
27	37	43
Change since 2000		
Percent Change	59.3%	
Avg. Annual Growth	4.23%	
Historic Trend	Steady growth from natural increase and in-migration.	
Local Prediction [1]	Continued growth.	
Median Age	18.8 years (2010) (youngest in region)	
Race/ Ethnicity	95% Alaska Native (highest in region), 5% White	

Age by Sex



Notes: 1/ Community is trying to recruit families **(21)**. Additional housing needed to accommodate desired growth **(23)**.

ECONOMY			
Overview	With decline in fishing, employment is primarily with local government. Some work in seasonal or part-time positions. (23).	Subsistence Resources	Most residents are heavily dependent on subsistence activities. Salmon, trout, char, deer, ducks, seal, and bear are harvested. **(4) (23)**
Employers	Main employers: IRA Council, KIBSD	Business Licenses	6
Total Wages	$457,312 (10)	Commercial Fishing	0 permits
Median Household Income[1]	$43,000 (10); $34,375 (23);	Seafood Processors	0
Residents over 16	25	Residents Employed	18 (72.0%) **(10)** / 13 (52.0%) **(21)**
Residents employed year-round[1]	14 (56.0%)	Below Poverty[1]	10.3% **(10)** / 65.5% **(23)**

ECONOMY
1/ A survey of household income and employment was conducted in 2012 in response to local opinion that American Community Survey (ACS) data for Karluk were inaccurate. Based on a sample of 45% of households, the survey found unemployment and poverty rates in Karluk to be significantly higher than ACS estimates with only about 25 percent of adults employed full time, 20 percent "temporary/seasonal," and 5 percent part time. Based on these findings, Karluk is petitioning the Denali Commission to be reclassified as a Distressed Community **(23)**.
Sources (except as noted): **(10)**

EDUCATION			
School	Grades K-12. School closed in 1999-2000 and 2002-2003 due to low enrollment **(13)**.		
Students	11 (2013-14)	**Teachers**	1 (2013-14)

LAND	
Land Ownership	Koniag Incorporated (surface and subsurface land rights) Airstrip (ADOT&PF); School (KIBSD)
Topography	Steep coastal bluffs rise up to 70 feet behind the shoreline of the lagoon. The seacoast is extremely rugged with vertical cliffs descending as much as 500 feet to the beach. Surrounding hills rise to elevations of up to 1,500 feet. The new town site is located in an area that abuts the steeply rising slopes of the lagoon banks**.**
Vegetation and Soils	The area is grassy and virtually treeless. Patches of brush occur in the more sheltered areas. The beaches primarily are sand and gravel. Soils are generally well-drained, silty-loam interstratified with layers of sand and gravel. Erosion is an issue in some areas of the community. Some residents have lost land to erosion.
Environmental Issues	Most of the Borough's inland wetlands are located in the Karluk River and Ayakulik River drainages, but are not considered to pose major development constraints due to low population in those areas. Erosion is an issue in some areas of the community.
Source: **(13)**	

TRANSPORTATION			
Road	No connector roads. A 1-mile gravel road connects community to airstrip. A road to Larsen Bay has been proposed, but would cross National Wildlife Refuge land.		
Marine	No harbor or docking facilities. No Alaska Marine Highway Service ferry service. Fuel is delivered by barge. Marine cargo services must use a landing craft to offload supplies. Local residents anchor off shore and use small crafts to haul in goods. A dock is being planned (Need to confirm.).		
Aviation	2,400 ft. runway can accommodate small commuter airlines. No crosswind runway or control tower. Regular scheduled flights but can be up to a week without service due to weather. Floatplane access at Karluk Lake. Due to runway length, fuel has been flown in in barrels, a day's worth at time at great expense **(23).**		
Vehicles	Light vehicles: 5-10 (1998)	Aircraft	NA
	Heavy equipment: 1 (1998)	Boats	NA
Sources (except as noted): **(13)**			

KODIAK

GENERAL INFORMATION			
CITY OF KODIAK			
Location	Northwestern tip of Kodiak Island		
City Government	Home Rule City	Tribal Government	Native Village of Afognak (federally recognized)
Taxes	7% sales tax		
CHINIAK			
Location	45 miles southeast of the city of Kodiak		
City Government	Unincorporated CDP	**Tribal Government**	No
Taxes	**N/A**		
KODIAK STATION			
Location	South and adjacent to city of Kodiak, US Coast Guard Base and housing		
City Government	Unincorporated CDP	**Tribal Government**	No
Taxes	**N/A**		
WOMENS BAY			
Location	8 miles south of the city of Kodiak		
City Government	Unincorporated CDP	**Tribal Government**	No
Taxes	**N/A**		

DEMOGRAPHICS						
KODIAK ROADBELT (*includes City of Kodiak, Chiniak, Kodiak Station and Woman's Bay*)			CITY OF KODIAK			
2000 Census 8,914	2010 Census 8,197	2013 (est.) **8,363**		2000 Census 6,334	2010 Census 6,130	2013 (est.) 6,338
Change since 2000				Change since 2000		
Percent Change	-6.18%			Percent Change	0.06%	
Avg. Annual Growth	-0.44%			Avg. Annual Growth	0.00%	
				Median Age	35.1 years (2010)	
				Race/Ethnicity	40% White/ 37.4%-Asian/ 9.9% Alaska Native / 6.3% Mixed race	
Source: **(9)**						

ECONOMY			
Overview	The local culture relies on commercial and subsistence fishing activities. The US Coast Guard comprises a significant portion of the community, and there is a large seasonal population. (4) (50)	Subsistence Resources	Important subsistence fisheries in the area include salmon (all five Pacific species), halibut and shellfish fisheries. Commercially various salmon species, king crab, pollock, cod, and other species.
Employers	Manufacturing/Trade, Transportation, Utilities/Local Gov't, Education	Business Licenses	1,132
Total Wages	$92,896,781	Commercial Fishing	567 permits
Median Household Income[1]	$60,972	Seafood Processors	11 land-based processors 2 vessel-based processors **(67)**
Residents over 16	4,822	Residents Employed	3,258 (68%)
Employed year-round	2,490 (76%)	Below Poverty	15.15%
Source: **(66)**			

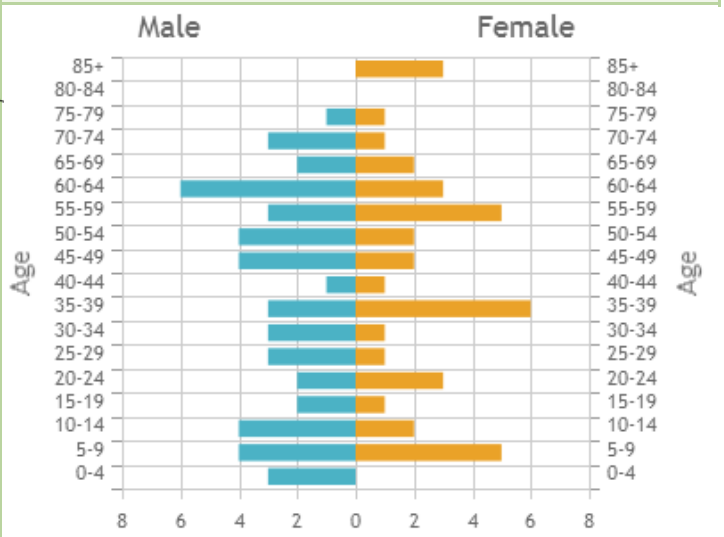
EDUCATION			
CITY OF KODIAK			
Schools	6		
Students	2096 (2013-14)		
CHINIAK			
School	GRADES K-10		
Students	12 (2013-14)	TEACHERS	2 (2013-14)
KODIAK STATION			
School	Grades P-5		
Students	284 (2013-14)	**Teachers**	16 (2013-14)
Source: **(6)**			

LARSEN BAY

GENERAL INFORMATION			
Location	Northwest coast of Kodiak Island, 60 miles southwest of the City of Kodiak and 283 miles southwest of Anchorage		
City Government	2nd Class; Incorporated 1974	Tribal Government	Native Village of Larsen Bay (federally recognized)
Taxes	3% sales tax		

DEMOGRAPHICS		
2000 Census	2010 Census	2013 (est.)
115	87	88
Change since 2000		
Percent Change	-23.48%	
Avg. Annual Growth	-1.68%	
Historic Trend	Steady decline through 2008. Has stabilized since	
Local Prediction	NA	
Median Age	43.5 years (2010)	
Race/Ethnicity	71.3% Alaska Native 24.1% White 4.6% Two or more races	

Age by Sex



ECONOMY			
Overview (4)	Primarily based on fishing. There are few year-round employment positions. Local lodges provide tourist guide services.	Subsistence Resources	A large majority of the population depends on subsistence. Salmon, halibut, seal, sea lion, crab, shellfish, deer are harvested.
Main Employers	Tribe, School District	Business Licenses	14
Total Wages	$894,801	Commercial Fishing (46)	12 permit holders 15 permits
Median Household Income	$85,357	Seafood Processors	1
Residents over 16	66	Residents Employed	47 (71.2%)
Residents employed year-round (10)	27 (40.1%)	Below Poverty	0 (0.0%)
Sources (except as noted): **(10)**			

EDUCATION			
School	Grades P-12		
Students	17 (2013-14)	**Teachers**	2 (2013-14)

LAND	
Land Ownership	Koniag Inc. Native Corporation (surface and sub-surface estates); significant land holdings close proximity to Larsen Bay are administered as federal land within the Kodiak National Wildlife Refuge; Airstrip (ADOT&PF); School (KIB)
Topography	The community is located along a gradually inclining beach. The coast is characterized by narrow straits and steep, rocky bluffs. Surrounding mountains reach 3,000 ft. Humpy Creek flows through the community into the Bay. **(68)**
Vegetation and Soils	High alder and willow brush predominates with scattered birch and cottonwood, with some locally heavy stands. No Sitka spruce or western hemlock. Grasses in open areas. Small areas of wetlands are found at the head of the bay with poorly drained soils. **(68)**
Environmental Issues	There are frequently active volcanoes near the area which can interrupt air service due to ash. Earthquake activity is frequent and sometimes extreme.
Sources (except as noted): **(13)**	

TRANSPORTATION			
Road	No connector roads. 3.5 miles of gravel roadway are maintained by the City.		
Marine	Small boat harbor with road access and limited facilities was built in 2003.		
Aviation	State owned 2,700 foot gravel airstrip, state planning calls for the airstrip to be extended to 3,300 feet to accommodate larger aircraft. Due to weather conditions the village often goes without service for up to a week at a time. An upgraded airport facility would assist the frequency of service.		
Vehicles	Light vehicles: 57 (1998)	Aircraft	NA
	Heavy equipment: 0 (1998)	Boats	NA
Sources (except as noted): **(13)**			

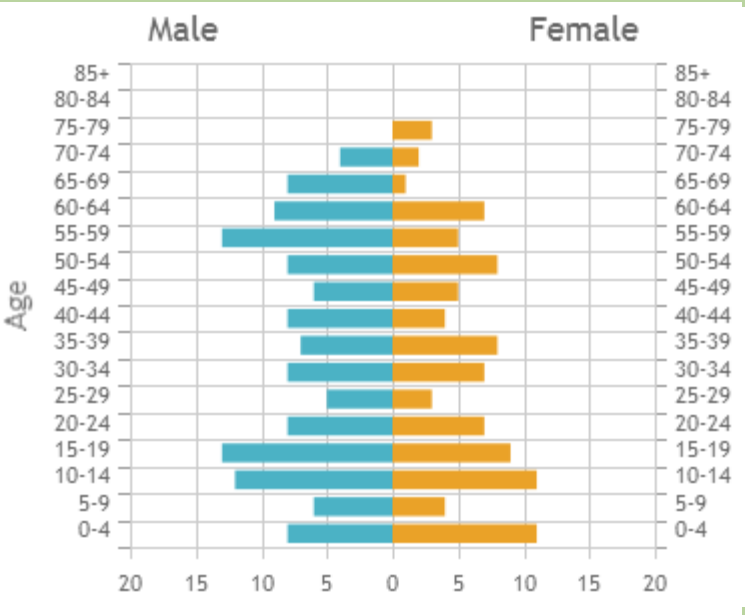
Old Harbor

GENERAL INFORMATION			
Location	Southeast coast of Kodiak Island, 70 miles southwest of the City of Kodiak and 322 miles southwest of Anchorage.		
City Government	2nd Class; Incorporated 1966	Tribal Government	Native Village of Old Harbor (federally recognized)
Taxes	3% sales tax		

DEMOGRAPHICS		
2000 Census	2010 Census	2013 (est.)
237	218	225

Change since 2000	
Percent Change	-5.06%
Avg. Annual Growth	-0.36%
Historic Trend	Decline since 2000, but stable for past 10 years.
Local Prediction	Stabilize or increase due to increased economic opportunity (69)
Median Age (9)	34.3 years (2010)
Race/Ethnicity (9)	87.6% Alaska Native /11% White / 1.4% Mixed race

Age by Sex



ECONOMY			
Overview	Commercial fishing and hunting is the mainstay of the economy. Most residents depend to some extent on subsistence food sources. (50)	Subsistence Resources	Salmon, halibut, crab, ducks, wild bird eggs, sea lion, sea otters, Sitka blacktail deer, seal, brown bear, fox, ermine, squirrels, and weasels
Employers	Local gov't 57.6%; construction 10.6%; and trade, transportation, utilities 8.2%. Main employers: Native Village of Old Harbor, Old Harbor City Council, KANA, KIBSD. (66)	Business Licenses	13
Total Wages	$1,469,914	Commercial Fishing	54 permits; Community Quota Entity **(66)**
Median Household Income[1]	$53,125	Seafood Processors	1 land-based 1 vessel-based **(67)**

ECONOMY			
Residents over 16	152	Residents Employed	85 (56%)
Employed year-round	14 (46%)	Below Poverty	22.22%
Sources (except as noted): **(10)**			

EDUCATION			
School	Grades P-12		
Students	32 (2013-14)	**Teachers**	4 (2013-14)

LAND	
Land Ownership	Old Harbor Native Corporation; State of Alaska (upland rights and lands significant for subsistence and commercial hunting, as well as tidelands and submerged lands); Federal Government also owns land and part of the Kodiak National Wildlife Refuge; Airstrip (ADOT&PF); School (KIB)
Topography	Rugged, mountainous landmass heavily glaciated during the last ice age resulting in sculpted peak and ridge systems separated by deeply carved bays and fjords. Area of magnificent beauty with mountains rising to up to 3,000 feet out of the surrounding oceans and bays. **(13)**
Vegetation and Soils	Varies significantly through the northern islands with Old Harbor located in the transition zone between high brush vegetation and alpine tundra. Dominant vegetation types include willow, aider, devil's club, bluejoint and fescue grasses, lupine, Jacobs ladder, ferns, sedges, and horsetail. **(13)**
Environmental Issues	Potential oil leakage on Sitkalidak Island. **(13)**

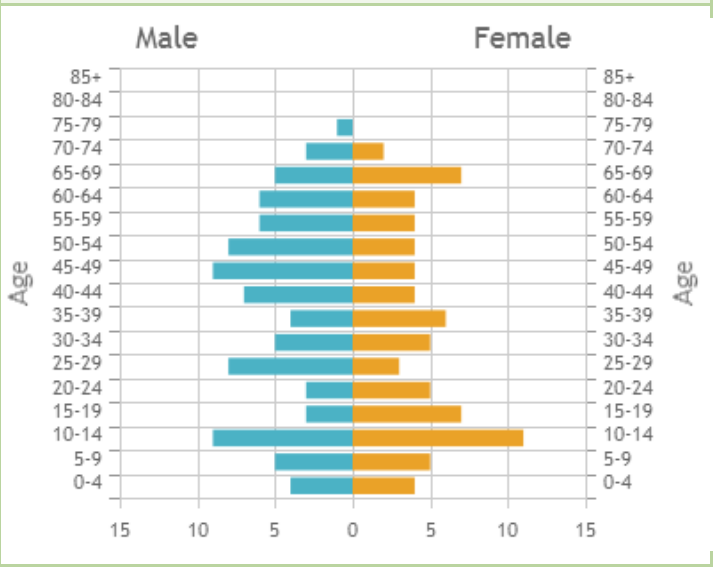
TRANSPORTATION			
Road	No connector roads**. (13)**		
Marine	Dock and small boat harbor built after the 1964 earthquake. Barge service is available from two Kodiak-based boat freight services. The small boat harbor has slips for approximately 55 small boats but has no water or electrical service. It has some structural damage and is also in need of repairs and expansion. **(13)**		
Aviation	2,750-foot gravel strip that is not large enough to accommodate larger, freight cargo aircraft. There is no cross runway or navigational equipment. **(13)**		
Vehicles	Light vehicles: 15-20 ATV: 25 (1998)	Aircraft	NA
	Heavy equipment: 5 (1998)	Boats	NA

OUZINKIE

General Information			
Location	West coast of Spruce Island, which is north of Kodiak Island and east of Afognak Island, and approximately 12 miles northwest of the city of Kodiak.		
City Government	2nd Class; Incorporated 1967	**Tribal Government**	Native Village of Ouzinkie (federally recognized)
Taxes	3% sales tax		

Demographics		
2000 Census	**2010 Census**	**2013 (est.)**
225	161	185
Change since 2000		
Percent Change	-17.78%	
Avg. Annual Growth	-1.27%	
Historic Trend	Decline since 2000, but stable for past 10 years.	
Local Prediction	Stabilize or increase due to increased economic opportunity (57)	
Median Age (9)	36.8 years (2010)	
Race/Ethnicity (9)	79.5% Alaska Native /10.6% White / 9.3% Mixed race	

Age by Sex



Economy			
Overview	Economic base is primarily commercial salmon fishing. Non-fishing employment is primarily with government, with significant part-time and seasonal work. (4) (50)	**Subsistence Resources**	Almost all the population depends to some extent on subsistence activities. Salmon, crab, halibut, shrimp, clams, ducks, deer, and rabbit are utilized. **(4)**
Employers	Local government, trade/transportation/ utilities, construction	**Business Licenses**	11
Total Wages	$1,583,356 (10)	**Commercial Fishing**	19 permits plus Community Quota Entity IFQ shares
Median Household Income[1]	$47,500 (10)	**Seafood Processors**	0
Residents over 16	157 (10)	**Residents Employed**	96 (61.1%) **(10)**
Employed year-round	53 (33.7%) (10)	**Below Poverty**	27.12% **(10)**

Education			
School	Grades K-12		
Students	43 (2013-14)	**Teachers**	5 (2013-14)

Land	
Land Ownership	Ouzinkie Native Corporation (surface land rights); Koniag, Inc. (subsurface rights).
Topography	Swampy areas, volcanic rock and soils, and sedimentary rock. Katmai Creek runs through the community. **(13)**
Vegetation and Soils	Soils are relatively shallow and poorly drained, with significant muskeg cover. There is an abundance of tall spruce. Other common plant species include bluejoint, beach and rye grasses, devil's club, ferns, salmonberry and high bush cranberry **(13)**.
Environmental Issues	Decline in harbor seals and sea lions. Paralytic shellfish poison. Several areas suffer from erosion, including the ridge along the west end of the airstrip, waterfront at Ouzinkie harbor, and tank farm access road. Indoor air quality: black mold. **(13)**

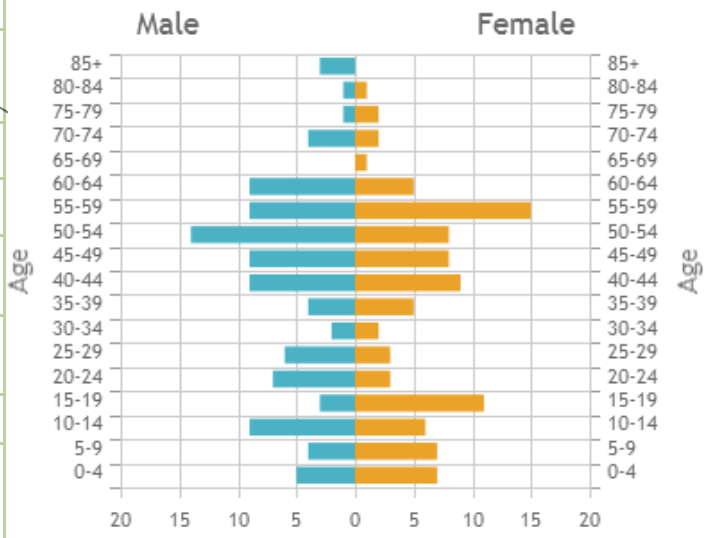
Transportation			
Road	No connector roads. The road system within Ouzinkie is limited to a few miles of gravel road and paths. **(13)**		
Marine	Ouzinkie harbor facilities include a breakwater, a small boat harbor and dock. Fuel is delivered by barge. An intra-island marine cargo vessel delivers freight on demand from Kodiak. Ouzinkie has a new dock, which was a community priority to support economic development and the possibility of AMHS ferry service. **(13)**		
Aviation	A state-owned 2,500-foot gravel runway is maintained by the City. Ouzinkie is served by scheduled passenger and mail trips and charter service between the City of Kodiak and Ouzinkie. The airstrip is not large enough to accommodate larger, freight cargo aircraft and lacks radar equipment. A float plane landing area is at Ouzinkie harbor. **(13)**		
Vehicles	Light vehicles: < 25 ATV: 20-40 (13)	**Aircraft**	NA
	Heavy equipment:	**Boats**	NA

PORT LIONS

GENERAL INFORMATION			
Location	Located in Settler Cove, on the north coast of Kodiak Island, 247 air miles southwest of Anchorage		
City Government	2nd Class; Incorporated 1966	Tribal Government	Native Village of Port Lions (federally recognized)
Municipal Taxes	0% sales tax, 5% bed tax		

DEMOGRAPHICS		
2000 Census	2010 Census	2013 (est.)
256	194	188
Change since 2000		
Percent Change	-26.6%	
Avg. Annual Growth	-1.9%	
Historic Trend	Steady decline has mostly stabilized since 2008	
Local Prediction	Preventing further decline is top community priority	
Median Age	44.3 years (2010)	
Race/Ethnicity	58.8% Alaska Native 36.1% White 2.6% Two or more races	

Age by Sex



ECONOMY			
Overview (4)	Primarily based on commercial fishing, fish processing, and tourism.	Subsistence Resources	All of the residents depend to some extent on subsistence. Salmon, crab, halibut, shrimp, clams, duck, seal, deer, and rabbit are harvested.
Main Employers	Tribe, School District	Business Licenses	19
Total Wages	$1,823,840	Commercial Fishing (46)	18 permits; CQE
Median Household Income	$46,875	Seafood Processors	0
Residents over 16	168	Residents Employed	82 (49%)
Residents employed year-round (2)	51 (62%)	Below Poverty	33 (12.7%)

Sources (except as noted): **(10)**

EDUCATION			
School	Grades K-12		
Students	20 (2013-14)	**Teachers**	2 (2013-14)

LAND	
Land Ownership	The single largest landowner in the areas is Afognak Native Corporation (ANC), which owns all of the land surrounding the City of Port Lions and half of the land within the City limits. The ANC was formed as a merger of Port Lions Native Corporation and Natives of Afognak in 1977 and is the ANCSA village corporation for Port Lions. Koniag, Inc., owns subsurface rights to ANC lands; Airstrip (ADOT&PF); School (KIB)
Topography	Port Lions lies in an area considered to be generally free of permafrost, though a few isolated masses of permafrost may be locally present. The surrounding terrain is gently sloping and heavily forested with Sitka spruce and coastal western hemlock. Major landforms include Mt. Ellison (elevation 2000 feet), approximately two miles from the village center, and Peregrebni Peninsula, a nearly 300 acres deposition formed area connected to the mainland by a narrow isthmus, which forms Settler Cove. **(70)**
Vegetation and Soils	Dominated by Sitka spruce and deciduous species, particularly Sitka alder and Dwarf birch. Low growing willows are found in cleared recovery areas or along stream areas. Due to a lack of soil depth and exposure conditions, the spruce give way to shrub species. The more common of these species are Labrador tea, blueberry, and low brush cranberry. The area above the head of Settler Cove consists of a mixture of spruce and shrub. **(70)**
Environmental Issues	The village center and the Peregrebni Peninsula are subject to long and short term coastal flooding due to land subsidence and seismic sea waves. During extreme high tides and severe wind conditions, the storm surge has crested Kizhuyak Drive. **(70)**
Sources (except as noted): **(13)**	

TRANSPORTATION			
Road	No connector roads. 6.5 miles of gravel roads within the community, included among the roads is a 4.2-mile state road connecting the City dock at Port Wakefield on Peregrebni Peninsula to the south end of the village and to the airstrip north of the village. Roads are in poor condition and are in need of repairs.		
Marine	The boat harbor was partially rebuilt in 2011 and provides 68 boat slips, electricity, and fresh water during the summer months. The state ferry Tustumena operates bi-weekly from November through April and bi weekly for two weeks each month from May through October. Service is to and from Kodiak and Homer. A newly built deep water city dock with a 214 ft. face and mooring and breasting dolphins to accommodate large ships will be completed in 2014.		
Aviation	There is a state-owned 2600 ft. gravel airstrip, and the small boat harbor may be used by seaplanes. Regular and charter flights are available from Kodiak		
Vehicles	Light vehicles: 20 (1998)	Aircraft	NA
	Heavy equipment: 9 (1998)	Boats	NA
Sources (except as noted): **(13)**			

APPENDIX B

NON-RESIDENTIAL BUILDING INVENTORY

Data gathered during community visits and by community members has not been added.

AKHIOK

Building Name	Building Type or Use	Owner	Year Built / Square Footage	Heating Fuel Type and Use	Electric Energy Use (kWh)	EE&C Audited? (Year)	Est. Cost of EE&C Measures	Est. EE&C Cost Savings/Yr	Est. EE&C Energy Savings/Yr	EE&C Imple-mented?
New clinic										
Pump house										
Fire Hall										
Garage										
School Generator										
School										
Public Bldg										
Generator										
Tribal Council Office										
Post Office										
Store										
Teen Center										
Church										

Source: (20)

KARLUK

Building Name	Building Type or Use	Owner	Year Built / Square Footage	Heating Fuel Type and Use	Electric Energy Use (kWh)	EE&C Audited? (Year)	Est. Cost of EE&C Measures	Est. EE&C Cost Savings/Yr	Est. EE&C Energy Savings/Yr	EE&C Imple-mented?
Water Storage Tank										
School										
School Generator										
Pump House										
Tribal Council Garage										
Generator										
Lodge										
Community Hall										
Lodge										
Tribal Council Office										
Smoke Houses										
Russian Orthodox Church										
Lodge										
Fuel Tank										
Airport Maintenance Bldg										

Source: (20)

KODIAK

AHFC Public Facilities Audits

Building Name	Building Type or Use	Owner	Year Built / Square Footage	Heating Fuel Type and Use	Electric Energy Use (kWh)	EE&C Audited? (Year)	Est. Cost of EE&C Measures	Est. EE&C Cost Savings/Yr	Est. EE&C Energy Savings/Yr	EE&C Imple-mented?
Main Elementary	School	KIBSD	37,062 sf	12,301 gals. #2 oil	295,036	AHFC (2012)	$110,250	$23,848		In Progress
Peterson Elementary	School	KIBSD	42,283 sf	17,128 gals. #2 oil	309,297	AHFC (2012)	$153,250	$17,554		In progress
Kodiak Middle School	School	KIBSD	60,876 sf	25,876 gals. #1 oil	900,457	AHFC (2012)	$171,256	$27,743		In progress
Chiniak School	School	KIBSD	8,450 sf	4,932 gals. #2 oil	52,574	AHFC (2012)	$68,068	$4,785		In progress
KIB Admin Building	Offices	KIB	28,567 sf	22,675 gals. #2 oil	434,532	AHFC (2012)	$145,310	$26,370		Complete
Bayside Fire Station	Fire Station	KIB	5,366 sf	NA	NA	AHFC (2012)	$26,226	$2,043		Unknown
Womens Bay Volunteer Fire Department	Fire Station	KIB	3,204 sf	NA	22,434 (2010)	AHFC (2012)	$22,726	$2,264		Unknown

Sources: (36) (37)**. Notes:** Complete Energy Audit Reports are available at: www.akenergyefficiency.org/koniag_audits

Other common efficiency measures include setting back the thermostat to 60° when buildings unoccupied, retrofitting lights and installing control systems on HVAC and pump systems. KIBSD is implementing changes as the opportunity arises whether in the course of regular maintenance or replacement of equipment.

U.S. Coast Guard Kodiak Base: Steam Plan Energy Efficiency Retrofits

Building	Measure	Investment Cost (estimated)	Annual Savings	Simple Payback (Years)
Steam Plant	Boiler Controls	$426,690	$129,300	3.3
	Feedwater Motor/pumps	$29,928	$12,470	2.4
	Lighting Upgrades	$1,540,302	$296,212	5.2

Sources: (38) (32). **Notes**: Retrofits completed or underway include upgrading controls on boiler, lighting, and HVAC; repairing and replacing existing steam distribution system; and replacing double doors in housing units. These measures have been implemented over the past 15 years.

City of Kodiak Public Facilities Inventory

Facility	Location	Year Built	Square Feet	Electrical Use (kWh)
City Police Station/Jail	2160 Mill Bay Road	2010	28,150	530,440
Baranoff Park Rec Facility	1222 Chichenoff	2000	25,578	282,528
Sewage Treatment Plant	2853 Spruce Cape Rd.	1971/1999	25,071	464,352
City Dock Warehouse	Pier II, St.Paul Harbor	1988	23,404	
Public Library	612 Egan Way	2013	16,000	74,640
Fire Station	219 Lower Mill Bay	1968/1982	13,000	11,366
Library	319 Lower Mill Bay	1967/1982	10,728	68,040
Teen Center	410 Cedar St	1984/2001	10,500	35,107
Public Works Garage	2410 Mill Bay	1977	8,302	108,202
Pier 3 Maintenance Shop	Rezanof Drive	1975	7,200	
Rec Facility/East Additional Park	Bartel & Simeonoff	1984	5,500	
Brother Francis Shelter	410 Thorsheim	1992	5,044	
UV Water Treatment w/ Generator	909 Pillar Mountain Road	2012	3,648	
Baranov Museum	101 Marine Way	1970	3,608	16,626
Public Works Warehouse	2410 Mill Bay	1995	3,200	17,155
Harbormaster Building	403 Marine way	1966/1998	2,604	10,280

Facility	Location	Year Built	Square Feet	Electrical Use (kWh)
Headstart Preschool	417 Hillside	1991	2,604	29
KPD Barn/Storage Facility	614 Egan Way	1945/2000	2,600	34,739
Pump Station	Monashka Creek	1973	2,519	2,125,440
Salt Storage Bldg.(PW Yard)	2410 Mill Bay	1997	1,888	4,016
Chamber Office/ Ferry Terminal	106 Marine Way	1970	1,792	
Baranoff Park-Office, Comfort Station, Storage	1222 Chichenoff	2000	1,456	8,888
Chlorinator Building	909 Pillar Mtn. Rd.	1995	1,339	335,808
St. Herman Harbor Office	St.Herman Harbor	1998	1,200	11,493
Animal Shelter	2409 Mill Bay Road	1981/2002	1,040	
Pier 3 Office	Rezanof Drive	1975	1,000	
Utility Enclosure & Restroom	Kodiak Boatyard - St.Herman Harbor	2009	836	17,632
Pump Station	Pillar Creek	1965	828	72,100
Lift Station/City #5- Contents Only	Mission Lake	1978/2000	600	
Comfort Station (Restroom)	St. Paul Spit	2000	350	
Public Restrooms	407 Marine Way	1989	350	
Communications Building Including Antennas & Fence	911 Pillar Mountain	2008	160	9,219
Lift Station/ SD#2 - Contents Only	Spruce Cape	1983	140	
Lift Station/City #4 - Contents Only	Father Herman Rd	1978	140	
Emergency Generator Building	2410 Mill Bay Road	1979	128	
Portable Security Shed	727 Shelikof Ave	2006	64	39,350

Source: (35)

Energy Use of Water and Sewer Facilities, City of Kodiak

Facility	Annual Electrical Use (kWh)
2821 Spruce Cape Sewage Plant	464,352
3010 Spruce Cape Rd Pump Sta 2	11,306
3880 Woodland Dr Pump Sta	4,561
4152 E Rezanof Dr Pump Station	74,000
Monashka Creek Pump Station	2,125,440
Pillar Creek Pump Station	72,100
Pillar Mtn Chlorinator	335,808
1211 Father Herman St Sewer Lift	103,200
2578 Metrokin Wy Sewer Lift Station	315,744
315 Seabreeze Cir Sewer Lift	4,292
3565 Sean Cir Sewer Lift Sta	12,448
438 Teal Way Sewer Lift Sta	4,590
511 Marine Way Sewer Lift Sta	39,200
518 Mozart Cir Sewer Lift	15,402
Beaver Lake Loop Rd Sewer Lift	3,083
Cliffside Rd Sewer Lift Station	1,614
Dog Bay Sewer Lift Pump #2	11,567
Larch Sewer Lift	3,549
Sewer Lift 1-Harry Neilsen Ave By Pond	6,710
Sewer Lift 2-Sut Larsen Way-End Of Road	3,198
Sewer Lift Station-By Elks	13,666
Shelikof St Sewer Lift	4,088
Total	**3,629,918**

Source: (35)

Kodiak College Building Inventory

Facility	Year Built	Square Feet	#2 Fuel Oil (gals.)	Electrical Use (kWh)	Vehicle Fuel (gals.)
Benny Benson	1971	15,530			
Campus Center	1982	14,916			
Technology Center	1973	13,664			
Total		**44,110**	**35,411**	**472,000**	**458**
Average per Building		**14,703**	**11,803**	**157,333**	
Average per Building (MMBTU)			**1,644**		

Source: (39)

LARSEN BAY

Building Name	Building Type or Use	Owner	Year Built / Square Footage	Heating Fuel Type and Use	Electric Energy Use (kWh)	EE&C Audited? (Year)	Est. Cost of EE&C Measures	Est. EE&C Cost Savings/Yr	Est. EE&C Energy Savings/Yr	EE&C Imple-mented?
Lodge										
Fishing Processing										
Tank Farm										
Tribal Office										
Airport Maintenance Bldg										
Clinic										
Post Office										
Fire Hall & VPSO Bldg										
City Generator										
City Offices										
City Maintenance Bldg										
Old School										
School	School	KIBSD	19,945 sf	#2 oil: 9,564 gals./yr (2009-10)	104,675 kWh/yr (2009-10)	AHFC (2012)	$190,794	$26,414		In Progress
Lodge										
Old Church (Storage)										
Russian										

Building Name	Building Type or Use	Owner	Year Built / Square Footage	Heating Fuel Type and Use	Electric Energy Use (kWh)	EE&C Audited? (Year)	Est. Cost of EE&C Measures	Est. EE&C Cost Savings/Yr	Est. EE&C Energy Savings/Yr	EE&C Imple-mented?
Orthodox Church										
Lodge										
Lodge										
Lodge										
Lodge										
Fish Processing										
KIHA Housing										
Old Water Storage tank										
Water Treatment Plant										
City Storage										
Tribal Office										
Cannery										

Sources: (20) (36) (37)

Old Harbor

Building Name	Building Type or Use	Owner	Year Built / Square Footage	Heating Fuel Type and Use	Electric Energy Use (kWh)	EE&C Audited? (Year)	Est. Cost of EE&C Measures	Est. EE&C Cost Savings/Yr	Est. EE&C Energy Savings/Yr	EE&C Imple-mented?
Orthodox Church										
Oil Spill Connex										
City Dock										
Lodge										
Senior Center						VEEP (2005-06)	$108 electrical savings	0.14 kW 19 gals. 14%		Lighting retrofit
Old Harbor School	School	KIBSD				VEEP (2005-06)	$5,134 electrical savings	6.7 kW 884 gals. 37%		Lighting retrofit
School Gymnasium	School	KIBSD				VEEP (2005-06)				Lighting retrofit
Tribal Council Office						VEEP (2005-06)	$3,041 electrical $340 fuel	4 kW 524 gals. 60%		Lighting, heating measures
Culture Center										
Post Office										
Basketball Court										
KANA Preschool						VEEP (2005-06)	$678 electrical savings	0.88 kw 117 gals. 55%		Lighting retrofit
Community Shop										
City Shop										
Water						VEEP		$186	0.24 kW	Lighting

Building Name	Building Type or Use	Owner	Year Built / Square Footage	Heating Fuel Type and Use	Electric Energy Use (kWh)	EE&C Audited? (Year)	Est. Cost of EE&C Measures	Est. EE&C Cost Savings/Yr	Est. EE&C Energy Savings/Yr	EE&C Imple-mented?
Treatment Bldg						(2005-06)		electrical savings	32 gals. 27%	retrofit
Art Studio										
Gwendolooks Grocery	Store									
The Fish Guy	Store									
Tidal Wave	Store									
Finest Fish Shop	Store									
City Fuel Tanks										
AVEC Fuel Tanks										
AVEC Generator										
Tribal Council Food Bank										
Lodge										
Clinic										
Old Clinic						VEEP (2005-06)		$761 electrical savings	1 kW 131 gals. 41%	Lighting retrofit
City Offices / Fire Hall / Public Safety						VEEP (2005-06)		$1,524 electrical $326 fuel	2 kW 262 gals. 44%	Lighting, heating measures
Gas Station										
City Storage										

Sources: (20) (36) (37) (71). **Notes**: Old Harbor completed the Village End Use Energy Efficiency Program (VEEP) in 2005-2006. Heating measures included outdoor temp boiler control on City Building, boiler maintenance training, and programmable thermostats for Tribal Office and City/Public Safety/Native Corp.

Building. Project cost was $38,235. Annual energy savings: 41% lighting, 17% fuel (for upgraded buildings) and 2,230 gallons of diesel. Simple payback: 3 years. (71)

OUZINKIE

Building Name	Building Type or Use	Owner	Year Built / Square Footage	Heating Fuel Type and Use	Electric Energy Use (kWh)	EE&C Audited? (Year)	Est. Cost of EE&C Measures	Est. EE&C Cost Savings/Yr	Est. EE&C Energy Savings/Yr	EE&C Imple-mented?
Ouzinkie School	School	KIBSD	16,918 sf	9,089 gals. #2 oil (2009-11 avg.)	140,127 (2009-11 avg.)	AHFC (2012)	$118,594	$15,724		In Progress
B&B										
Church										
Bulk Fuel Tanks										
EPA Multi-Use										
Subsistence Freeze Facility										
Fire Hall										
Community Center										
City Office										
Post Office										
Warehouse and Multi-use Building										
Church										
Tribal Cultural Center										
Tribal Health Clinic										
Generator Building										
City										

Building Name	Building Type or Use	Owner	Year Built / Square Footage	Heating Fuel Type and Use	Electric Energy Use (kWh)	EE&C Audited? (Year)	Est. Cost of EE&C Measures	Est. EE&C Cost Savings/Yr	Est. EE&C Energy Savings/Yr	EE&C Imple-mented?
Maintenance Building										
Septic Storage Building										
Oil Spill Response Center										
Grader Building										
Automotive Shop										
Studio										
Pump House										

Sources: (20) (36) (37)

PORT LIONS

Building Name	Building Type or Use	Owner	Year Built / Square Footage	Heating Fuel Type and Use	Electric Energy Use (kWh)	EE&C Audited? (Year)	Est. Cost of EE&C Measures	Est. EE&C Cost Savings/Yr	Est. EE&C Energy Savings/Yr	EE&C Imple-mented?
Health Clinic										
New Water Treatment Bldg										
Old Water Treatment Bldg										
Hillside Bable Chapel										
Fire Station & City Shop										
Park										
City Office Building	Office		4,800 sf			EECBG	$4,375	$110	800 kWh	Interior Lighting Retrofit
Russian Orthodox Church										
Telephone Company										
Lodge										
Tribal Offices										
Basketball Court										
Port Lions School										
Post Office										

Sources: (20) (25)

APPENDIX C

STAKEHOLDER OUTREACH – APRIL 2014 FORUM

This includes results from Akhiok and Ouzinkie only due to small pool of respondents from other communities.

STAKEHOLDER OUTREACH: APRIL LEADERSHIP FORUM — 11 AKHIOK RESPONDENTS			
What do you think has the greatest potential to lower your community's energy costs?			
42%	Wind	**10%**	Solar
10.5%	Hydro	**6%**	Port/Dock Facilities
10.5%	Energy Efficiency	**0%**	Transmission Lines
10.5%	Biomass	**0%**	Heat Pumps
10.5%	Diesel Efficiency		
What is most important to your community in terms of energy planning?			
27%	More reliable energy	**18%**	Community sustainability
27%	Saving money	**0%**	Price stability
27%	Saving energy		
Has a heat recovery system been installed in your community's diesel powerhouse?			
0% Yes	**60%** No	**40%** Don't Know	
What do you think is the biggest barrier to more participation in residential EE& programs in your community?			
70%	Lack of information	**0%**	Need to pay upfront and wait for reimbursement
30%	Other	**0%**	Hard to find auditors
Do you think we should look at an in-region approach to promoting EE&C?			
70% Yes	**20%** No	**10%** Don't Know	
Should our Regional Energy Plan include goals for energy efficiency?			
80% Yes	**20%** No	**0%** Don't Know	
If you could only invest in one project, which would you favor?			
44%	Long-term project (20 year development) that reduced energy costs significantly		
56%	Near-term project with more modest savings that could be built in 3-5 years		
Do you think there is enough wood biomass near your community to help with space heating needs?			
70%	Probably enough if managed wisely	**0%**	Not enough
30%	Don't know	**0%**	More than enough
If there is not enough biomass for everyone, how should the resource be managed?			
50%	Home heating should always come first		
25%	Priority should be given to uses that benefit the whole community		
12.5%	Some used to lower heating costs for community buildings		
12.5%	Other / No opinion		
Should strategies to encourage local food production be included as part of an energy plan?			
80% Yes	**10%** No	**10%** Don't Know	
When considering limited public funding, how should the state prioritize projects?			
37.5%	Community sustainability criteria		
25%	Balance state funding efficiency with community benefits		
25%	Projects that can't be privately financed		
12.5%	State funding efficiency		

STAKEHOLDER OUTREACH: GOALS FROM 2009 KIB REGIONAL ENERGY PLAN—11 AKHIOK RESPONDENTS

Study feasibility of passive and active solar residential hot water heating

Has there been Progress in Your Community?					Is this Still a Goal?		
No Action	Initial Steps	Substantial Progress	Mostly Complete	I have no idea	Yes	No	Don't Know
10%	30%	20%	20%	20%	100%	0%	0%

Assess need for upgrades to rural electrical grids (transmission/distribution lines, transformers)

Has there been Progress in Your Community?					Is this Still a Goal?		
No Action	Initial Steps	Substantial Progress	Mostly Complete	I have no idea	Yes	No	Don't Know
30%	10%	0%	10%	50%	90%	0%	10%

Upgrade building heating systems for energy efficiency and cost savings

Has there been Progress in Your Community?					Is this Still a Goal?		
No Action	Initial Steps	Substantial Progress	Mostly Complete	I have no idea	Yes	No	Don't Know
11%	44%	0%	0%	44%	86%	0%	14%

Install Met towers in communities to assess feasibility for wind power generation

Has there been Progress in Your Community?					Is this Still a Goal?		
No Action	Initial Steps	Substantial Progress	Mostly Complete	I have no idea	Yes	No	Don't Know
60%	10%	0%	0%	30%	78%	0%	22%

Encourage energy conservation (through energy efficient lighting and energy saving devices and behaviors)

Has there been Progress in Your Community?					Is this Still a Goal?		
No Action	Initial Steps	Substantial Progress	Mostly Complete	I have no idea	Yes	No	Don't Know
12%	25%	25%	12%	25%	75%	0%	25%

Assess need for active recycling program and designated recycling building in each community

Has there been Progress in Your Community?					Is this Still a Goal?		
No Action	Initial Steps	Substantial Progress	Mostly Complete	I have no idea	Yes	No	Don't Know
40%	30%	10%	0%	20%	60%	20%	20%

Work with KIHA and utilities to do energy rating on all homes

Has there been Progress in Your Community?					Is this Still a Goal?		
No Action	Initial Steps	Substantial Progress	Mostly Complete	I have no idea	Yes	No	Don't Know
22%	33%	11%	0%	33%	57%	14%	29%

STAKEHOLDER OUTREACH: GOALS FROM 2009 KIB REGIONAL ENERGY PLAN—11 AKHIOK RESPONDENTS

Assess heat recovery potential in diesel-fired power plants

Has there been Progress in Your Community?					Is this Still a Goal?		
No Action	Initial Steps	Substantial Progress	Mostly Complete	I have no idea	Yes	No	Don't Know
56%	22%	0%	0%	22%	50%	30%	20%

Assess potential to increase power generation from existing hydro facilities

Has there been Progress in Your Community?					Is this Still a Goal?		
No Action	Initial Steps	Substantial Progress	Mostly Complete	I have no idea	Yes	No	Don't Know
33%	0%	0%	0%	67%	33%	50%	17%

Institute "Cash for Clunkers" style program for older appliances (refrigerators, dryers, etc.)

Has there been Progress in Your Community?					Is this Still a Goal?		
No Action	Initial Steps	Substantial Progress	Mostly Complete	I have no idea	Yes	No	Don't Know
20%	20%	10%	0%	50%	22%	11%	67%

Study feasibility of low-head hydro

Has there been Progress in Your Community?					Is this Still a Goal?		
No Action	Initial Steps	Substantial Progress	Mostly Complete	I have no idea	Yes	No	Don't Know
60%	0%	0%	0%	40%	22%	44%	33%

Study feasibility of emerging technologies for harnessing tidal and wave energy

Has there been Progress in Your Community?					Is this Still a Goal?		
No Action	Initial Steps	Substantial Progress	Mostly Complete	I have no idea	Yes	No	Don't Know
25%	0%	0%	0%	75%	22%	33%	44%

What are the top three priorities from 2009 energy goals?

24%	Met Towers for Wind	**7%**	Community Recycling
23%	Energy Conservation	**4%**	Home Energy Audits
15%	Building Heating	**4%**	Cash for Clunkers
10%	Ocean/Tidal Energy	**4%**	Solar Hot Water
8%	Grid Upgrade Needs	**0%**	Low-head Hydro

STAKEHOLDER OUTREACH: APRIL LEADERSHIP FORUM — 10 OUZINKIE RESPONDENTS			
What do you think has the greatest potential to lower your community's energy costs?			
49%	Wind	**0%**	Diesel Efficiency
32%	Hydro	**0%**	Port/Dock Facilities
12%	Energy Efficiency	**0%**	Transmission Lines
7%	Solar	**0%**	Heat Pumps
0%	Biomass		
What is most important to your community in terms of energy planning?			
40%	More reliable energy	**20%**	Saving energy
20%	Saving money	**10%**	Price stability
20%	Community sustainability		
Has a heat recovery system been installed in your community's diesel powerhouse?			
11% Yes		**67%** No	**22%** Don't Know
What do you think is the biggest barrier to more participation in residential EE& programs in your community?			
30%	Lack of information	**40%**	Need to pay upfront and wait for reimbursement
20%	Other	**10%**	Hard to find auditors
Do you think we should look at an in-region approach to promoting EE&C?			
67% Yes		**0%** No	**33%** Don't Know
Should our Regional Energy Plan include goals for energy efficiency?			
100% Yes		**0%** No	**0%** Don't Know
If you could only invest in one project, which would you favor?			
56%	Long-term project (20 year development) that reduced energy costs significantly		
44%	Near-term project with more modest savings that could be built in 3-5 years		
Do you think there is enough wood biomass near your community to help with space heating needs?			
60%	More than enough	**0%**	Don't know
40%	Probably enough if managed wisely	**0%**	Not enough
If there is not enough biomass for everyone, how should the resource be managed?			
56%	Priority should be given to uses that benefit the whole community		
33%	Home heating should always come first		
11%	Other / No opinion		
0%	Some used to lower heating costs for community buildings		
Should strategies to encourage local food production be included as part of an energy plan?			
67% Yes		**11%** No	**22%** Don't Know
When considering limited public funding, how should the state prioritize projects?			
40%	Community sustainability criteria		
30%	State funding efficiency		
20%	Balance state funding efficiency with community benefits		
10%	Projects that can't be privately financed		

STAKEHOLDER OUTREACH: GOALS FROM 2009 KIB REGIONAL ENERGY PLAN—11 OUZINKIE RESPONDENTS

Assess potential to increase power generation from existing hydro facilities

Has there been Progress in Your Community?					Is this Still a Goal?		
No Action	Initial Steps	Substantial Progress	Mostly Complete	I have no idea	Yes	No	Don't Know
0%	67%	11%	11%	11%	100%	0%	0%

Assess need for upgrades to rural electrical grids (transmission /distribution lines, transformers)

Has there been Progress in Your Community?					Is this Still a Goal?		
No Action	Initial Steps	Substantia l Progress	Mostly Complete	I have no idea	Yes	No	Don't Know
11%	22%	22%	0%	44%	82%	0%	18%

Encourage energy conservation (through energy efficient lighting and energy saving devices and behaviors)

Has there been Progress in Your Community?					Is this Still a Goal?		
No Action	Initial Steps	Substantia l Progress	Mostly Complete	I have no idea	Yes	No	Don't Know
0%	44%	11%	0%	44%	81%	0%	18%

Install Met towers in communities to assess feasibility for wind power generation

Has there been Progress in Your Community?					Is this Still a Goal?		
No Action	Initial Steps	Substantia l Progress	Mostly Complete	I have no idea	Yes	No	Don't Know
10%	40%	10%	0%	40%	80%	0%	20%

Study feasibility of passive and active solar residential hot water heating

Has there been Progress in Your Community?					Is this Still a Goal?		
No Action	Initial Steps	Substantia l Progress	Mostly Complete	I have no idea	Yes	No	Don't Know
11%	56%	0%	0%	33%	73%	0%	27%

Assess heat recovery potential in diesel-fired power plants

Has there been Progress in Your Community?					Is this Still a Goal?		
No Action	Initial Steps	Substantia l Progress	Mostly Complete	I have no idea	Yes	No	Don't Know
50%	40%	0%	0%	10%	73%	9%	18%

Upgrade building heating systems for energy efficiency and cost savings

Has there been Progress in Your Community?					Is this Still a Goal?		
No Action	Initial Steps	Substantia l Progress	Mostly Complete	I have no idea	Yes	No	Don't Know

STAKEHOLDER OUTREACH: GOALS FROM 2009 KIB REGIONAL ENERGY PLAN—11 OUZINKIE RESPONDENTS							
11%	33%	22%	0%	33%	71%	0%	29%

Assess need for active recycling program and designated recycling building in each community

Has there been Progress in Your Community?					Is this Still a Goal?		
No Action	Initial Steps	Substantial Progress	Mostly Complete	I have no idea	Yes	No	Don't Know
27%	45%	0%	0%	27%	70%	0%	30%

Study feasibility of emerging technologies for harnessing tidal and wave energy

Has there been Progress in Your Community?					Is this Still a Goal?		
No Action	Initial Steps	Substantial Progress	Mostly Complete	I have no idea	Yes	No	Don't Know
50%	20%	0%	0%	30%	70%	10%	20%

Work with KIHA and utilities to do energy rating on all homes

Has there been Progress in Your Community?					Is this Still a Goal?		
No Action	Initial Steps	Substantial Progress	Mostly Complete	I have no idea	Yes	No	Don't Know
30%	20%	0%	10%	40%	67%	11%	22%

Institute "Cash for Clunkers" style program for older appliances (refrigerators, dryers, etc.)

Has there been Progress in Your Community?					Is this Still a Goal?		
No Action	Initial Steps	Substantial Progress	Mostly Complete	I have no idea	Yes	No	Don't Know
64%	27%	0%	0%	9%	60%	10%	30%

Study feasibility of low-head hydro

Has there been Progress in Your Community?					Is this Still a Goal?		
No Action	Initial Steps	Substantial Progress	Mostly Complete	I have no idea	Yes	No	Don't Know
22%	22%	0%	11%	44%	38%	12%	50%

What are the top three priorities from 2009 energy goals?

30%	Grid Upgrade Needs	**6%**	Ocean/Tidal Energy
14%	Met Towers for Wind	**6%**	Cash for Clunkers
13%	Home Energy Audits	**3%**	Community Recycling
13%	Energy Conservation	**3%**	Building Heating
10%	Solar Hot Water	**3%**	Low Head Hydro

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