Prince William Sound

Regional Energy Plan

WHPacific, Incorporated

Information Insights, Incorporated

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prince william sound
ECONOMIC DEVELOPMENT DISTRICT

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ACRONYMS AND ABBREVIATIONS

ACEP	Alaska Center for Energy and Power
AEA	Alaska Energy Authority
AHFC	Alaska Housing Finance Corporation
AIDEA	Alaska Industrial Development and Export Authority
AMR systems	Automated meter reading systems
ANCSA	Alaska Native Claims Settlement Act
ANGDA	Alaska Natural Gas Development Authority
ANTHC	Alaska Native Tribal Health Consortium
ARDOR	Alaska Regional Development Organizations
ARECA	Alaska Rural Electric Cooperative Association
ARIS	Alaska Retrofit Information System
ARRA	American Recovery and Reinvestment Act
ARUC	Alaska Rural Utility Collaborative
ASRC	Arctic Slope Regional Corporation
AVEC	Alaska Village Electric Cooperative
BIA	Bureau of Indian Affairs
BLM	Bureau of Land Management
BEES	Building Energy Efficiency Standards
CDR	Conceptual Design Report
CETF	Community Energy Task Force
CFL	Compact Fluorescent Light
CIAP	Coastal Impact Assistance Program
CIP	Capital Improvement Program
EfW	Energy From Waste
DCCED	Department of Commerce, Community and Economic Development
DOE	U.S. Department of Energy
DOL	Alaska Department of Labor (and Workforce Development)
DOT&PF	Alaska Department of Transportation and Public Facilities
EEM	Energy Efficiency Measures
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
ETF	Energy Technology Fund
EUI	Energy Use Index
FERC	Federal Energy Regulatory Commission
FHWA	Federal Highway Administration
HUD	U.S. Department of Housing and Urban Development
HVDC	High Voltage Direct Current
ICDBG	Indian Community Development Block Grant
IGA	Investment Grade Audit
IPP	Independent Power Producer
ISER	Institute for Social and Economic Research
kW	Kilowatt

kWh	Kilowatt hour
Mcf	One thousand cubic feet
MWh	Megawatt hours
NAHASDA	Native American Housing and Self Determination Act
NIST	National Institute for Standards and Technology
NOAA	National Oceanic and Atmospheric Administration
NRECA	National Rural Electric Cooperative Association
NREL	National Renewable Energy Laboratory
ORC	Organic Rankine Cycle
PFD	Permanent Fund Dividend
PCE	Power Cost Equalization
PD&R	Policy Development and Research
PV	Photovoltaic
PWS	Prince William Sound
PWSEDD	Prince William Sound Economic Development District
REAP	Renewable Energy Alaska Project
RUBA	Rural Utility Business Advisor
TED	The Energy Detective
UAF	University of Alaska Fairbanks
UCG	Underground Coal Gasification
USACE	United States Army Corps of Engineers
WtE	Waste to Energy
WTP	Water Treatment Plant

EXECUTIVE SUMMARY

This section provides a condensed version of the Prince William Sound Regional Energy Plan

EXECUTIVE SUMMARY

In 2015, the Prince William Sound Economic Development District (PWSEDD) - under contract with the State of Alaska Energy Authority (AEA) - took a pro-active step to review energy issues in the five Prince William Sound communities. These communities included Chenega Bay, Cordova, Tatitlek, Whittier and Valdez. PWSEDD hired WHPacific, Inc. to help develop the Prince William Sound Regional Energy Plan as part of a statewide effort. This plan is one of ten energy plans currently being vetted throughout the state. This plan would provide a regional energy vision that would then provide the framework for future energy development in the Prince William Sound region.

This energy plan coincides with the updates to the PWSEDD Comprehensive Plan, which allows a holistic approach to future project development in the PWSEDD communities. This plan shows the current energy resources within the region and presents options for reducing energy costs while maintaining or improving the current level of service provided. Data collected previously by federal, state and local energy specialists and the assistance of community leaders was used to prepare the draft energy plan. It is an expansion of previous studies and data collection and lays out issues, goals and prioritized energy projects obtained through a series of community meetings and document reviews. The goal is for this plan to become a living document that provides a tool for current and future generations on energy-related projects.

This energy plan is based on a local, grassroots perspective. Each community was visited and its issues, goals and prioritized projects are highlighted on individual community and energy profiles. These “snapshots” in time show the current energy-related conditions. A goal of the planning effort to continue to build upon this to create a unified voice for these five Prince William Sound communities and create a platform for regional-level energy projects. The community outreach meetings also identified data gaps and data errors, which will need to be addressed in future planning efforts.

The chart below summarizes issues, goals and potential projects for the Prince William Sound region. These projects are discussed in more detail throughout the plan.

ENERGY ISSUES	ENERGY GOALS	POTENTIAL PROJECT(S)
Energy Efficiency & Conservation		
Lack of education in energy-efficiency and conservation, no tracking of energy costs, inefficient housing design for climate and no present best practices in place.	Provide adequate energy education in all levels and areas. Calculate life-cycle costs for all energy systems. Set standards and best practices for climate appropriate design and construction.	▪ Energy-wise educational visits to all residential homes ▪ Data metering and collection for all energy systems ▪ Implement through an ESCO program all recommendations on energy audits
Maintenance and Operations		
Lack of trained workforce in energy-related systems at the local level, causing high maintenance and operations expenses.	Continue to train and develop a local workforce of operators and repair technicians for all energy systems. Train local workforce to do construction upgrades for efficiency.	▪ Institute a curriculum on energy-related jobs with local secondary and college educators to promote and design climate appropriate approach
Energy Financing		
Outside funding for energy projects is limited and highly competitive; costs for energy systems continue to grow – stressing current budgets, high energy rates and difficult financial environment.	Seek Federal and State technical assistance for planning of future energy projects. Collaborate funding efforts. Develop comprehensive financial strategy for maximizing energy funding.	▪ Create a funding database for collaboration of federal, state, local and private funds for energy projects
Energy Infrastructure		
Inappropriately designed energy systems have led to very high M&O costs; failing systems (due to design flaws and climate change) continue to drive costs up on all infrastructure – roads, water and sewer, housing stock, transmission lines; energy systems rely heavily on diesel and need upgrades to accept renewable systems.	Assess current infrastructure and develop an implementation plan for upgrades. Assess housing stock conditions. Upgrades systems to accept renewable energy. Diversify energy sources through use of alternatives.	▪ Implementation plan for current needs ▪ Energy audits on all commercial/public buildings ▪ Assess current energy systems for upgrades to be more efficient

Planning		
Lack of effective planning efforts for implementation of recommendations for energy savings and projects.	Incorporate the Prince William Sound Regional Energy Plan into the regional comprehensive plans.	- Implement a sustainable placeholder for updates of regional plan
Communication		
Logistics of the Prince William Sound communities hinders effective communication between entities and project partners; general public lacks understanding of current systems; conservation measures and available programs.	Utilize communication structure in place to continue to educate and bring awareness and resources to all residents. Educate energy users on energy consumption, energy systems and resources available.	- Implement the Energy-wise program to help consumers understand energy systems, distribution costs, usage and conservation

CHAPTER 1

Introduction

INTRODUCTION

This chapter introduces the plan, describes what it is and what it is not, outlines the methodology, presents the plan organization and summarizes the energy issues and goals.

INTRODUCTION

The Prince William Sound Regional Energy Plan is part of a statewide, multi-phased effort to identify energy projects and initiatives that will help reduce the long-term cost of energy and dependence on fossil fuels, and help improve existing energy systems. This project is funded by the State of Alaska Energy Authority (AEA).

Prince William Sound Economic Development District (PWSEDD) took the lead in preparing this regional energy plan for the Prince William Sound Region. The overall goal is to identify region-wide energy priorities that could reduce the long-term cost of power and improve energy systems in the region. Throughout this planning process, the focus was on identifying energy projects that provide stable, sustainable energy, helping the region become more energy efficient, and reducing costs to consumers. To help prepare the plan PWSEDD contracted with WHPacific, Inc. and Information Insights, Inc.

> **PWSEDD MISSION**
>
> The mission of Prince William Sound Economic Development District is to serve as a forum for the discussion of regional economic issues and to foster economic growth and job creation through strategic planning and infrastructure development.

The Energy Plan is intended to accomplish the following:

- Provide an energy profile for the region and each community in the region that clearly demonstrates their energy issues, the current energy usage and their energy opportunities.
- Outline a process for educating residents about energy conservation and efficiency measures.
- Assist in obtaining grants that reduce energy costs.
- Develop guidance for sound alternative resource development.
- Help to identify and set priorities for actions by the regional entities and their communities.
- Save costs and increase comfort for residents resulting from energy efficiency improvements.
- Be a part of each community's comprehensive plan.

The Energy Plan is not intended to:

- Remain a static document. The plan should evolve as time passes to reflect current economic realities, political constraints and opportunities, and technology.
- Serve as a design document. The plan does not capture a high level of detail surrounding energy projects, and most recommended projects will require standard pre-design and design documentation.

A. METHODOLOGY

The data collected for this report was gathered from existing reports, databases, and agencies, including the Alaska Energy Authority Energy Pathways and End Use Survey, the AHFC Alaska Retrofit Information System (ARIS), Alaska Home Energy Rebate Program and Weatherization Program, Power Cost Equalization Reports, Institute of Social and Economic Research (ISER), Alaska Native Tribal Health Consortium (ANTHC) and energy audits and data collected by numerous stakeholders.

Current energy data was derived from the information provided by utility providers, government officials, and local power plant personnel. Throughout the process, stakeholder input was solicited and the project team met to discuss progress.

Stakeholders key to the development of this energy plan include local, federal and state agency staff and the general public. In April 2015, planners held a kick off meeting with the PWSEDD board where the general process of the energy plan was discussed along with the issues and potential data sources. The board also created vision for a Prince William Sound energy system.

B. VISION

As energy costs rise and new energy technology emerges, leaders have recognized the need to develop a new coordinated energy approach for the region to bring costs down while maintaining or improving the level of service. At the kick off meeting held in April 2015, the PWSEDD Board of Directors developed the following vision:

Prince William Sound Regional Energy Vision

A visionary sustainable, redundant and adaptable energy system designed to optimize the use of local, alternative and renewable resources.

C. ORGANIZATION

This plan contains the following chapters:

- Introduction – an overview of the regional energy issues and challenges, the goals of the plan, methodology, and stakeholders involved.
- Regional Background – a summary of the physical, demographic, and energy use characteristics of the region.
- Regional Energy Analysis – a detailed look at the energy resources of the Prince William Sound region and an overview of regional energy priorities.
- Community and Energy Profile Summaries – an overview of the Prince William Sound communities, their energy profiles, and local energy priorities.
- Community Outreach – a summary of community meetings to discuss local level issues.
- Implementation Plan – a summary of actions and strategy for completing the energy priorities.

D. ISSUES AND GOALS

The following issues are a result of discussions with the Alaska Energy Authority, stakeholders, community members and a workshop with the PWSEDD board.

Energy Issues	Energy Goals
Energy Efficiency & Conservation	
■ **Public building energy efficiency upgrades are needed. Some audits are completed but not implemented.**	***Goal 1.*** *All public buildings are audited and energy efficiency upgrades completed.*
■ **There is a lack of education and practice in energy efficiency and conservation.**	***Goal 2.*** *Residents in the Prince William Sound Region are well educated in and practice energy conservation, understand how their energy and heating systems operate, and know what energy resources are available to them.*
■ **Houses and associated infrastructure are not usually built with cold climate design.**	***Goal 3.*** *All new buildings are climate appropriate and energy efficient.*
■ **There is no central location for energy information and resources.**	***Goal 4.*** *There is a well-maintained and updated clearinghouse that provides information about energy programs, resources, contacts, etc.*
■ **Some state and federal energy and conservation programs are not being implemented due to excessive requirements (such as the revolving loan program) or the structure of the programs does not fit the reality of rural energy needs.**	***Goal 5.*** *State and Federal energy and conservation programs are restructured to maximize their use and benefits for rural residents.*
Maintenance and Operations	
■ **The cost for ongoing operations of energy systems continues to grow without corresponding increases to budget.**	***Goal 6.*** *Budgeting practices reflect the need to maintain the existing energy system.*
■ **Smaller utilities often do not have the administrative capacity to efficiently operate their utility.**	***Goal 7.*** *Utility personnel are well trained and can effectively manage their energy programs and can react to the changing marketplace.*

Planning	
The energy vision is new and unknown among residents and stakeholders and there is no group to advocate for energy projects or monitor progress.	*Goal 8.* *A unified energy vision is well known to residents and stakeholders, and a group is established to maintain the regional energy plan, and to lobby for, monitor progress, and ensure completion of needed energy projects.*
There is a lack of effective planning efforts that showcase current energy demands, systems and costs that could help streamline future energy projects.	*Goal 9.* *The energy plan for the region is updated regularly and it outlines a realistic, implementable path towards energy independence and sustainability based on stakeholder input.*
There is a lack of investment on a long term sustainable approach to energy.	*Goal 10.* *Alaska legislators and federal agencies understand the benefit of long term energy investments and support them through the CIP process.* *Goal 11.* *Energy goals and priorities are incorporated into local, regional, state and federal planning and CIP processes.*
The younger generation is generally not brought to the table in energy discussions and advocacy.	*Goal 12.* *At least one student or youth is part of the energy stakeholder group.*
Energy Infrastructure	
Inadequate infrastructure remains a prevailing deficit throughout the region, including schools and homes that are generally over 30 years old.	*Goal 13.* *Integrated power systems exist throughout the region that effectively capture alternative energy.*
Failing systems result in high costs due to climate change and inadequate design.	*Goal 14.* *All infrastructure in the region is built, upgraded, retrofitted, or redesigned for current environmental and climate settings.*
Changing environmental conditions such as lack of snow impact the viability of sustainable energy.	*Goal 15.* *Throughout the region, our energy systems are redundant and adaptable.*

Energy Financing	
The customer base – particularly among commercial businesses – is shrinking, increasing user rates as utilities adjust pricing to cover fixed costs.	**Goal 16.** *Energy systems are diversified, flexible and can adapt to fluctuations in the customer base.*
Energy systems rely heavily on diesel, which is finite and constantly increasing in costs.	**Goal 17.** *Fuel costs are stabilized due to diversified energy sources through implementation of practical energy alternatives.*
Energy project financing from outside sources is limited and highly competitive.	**Goal 18.** *Federal, state and private partnerships provide funding through a full range of project grants, technical assistance and creative financing mechanisms.*
Actual costs of energy in region are not tracked adequately.	**Goal 19.** *Life-cycle energy costs for water and sewer systems, infrastructure, housing and power generation are well documented, understood and updated on a regular basis.*
There is a lack of a diversified approach to funding energy projects, with larger projects getting most of the attention.	**Goal 20.** *A variety of energy projects are funded – including assistance to small business – that save energy costs and employ people.*

CHAPTER 2

Regional Background

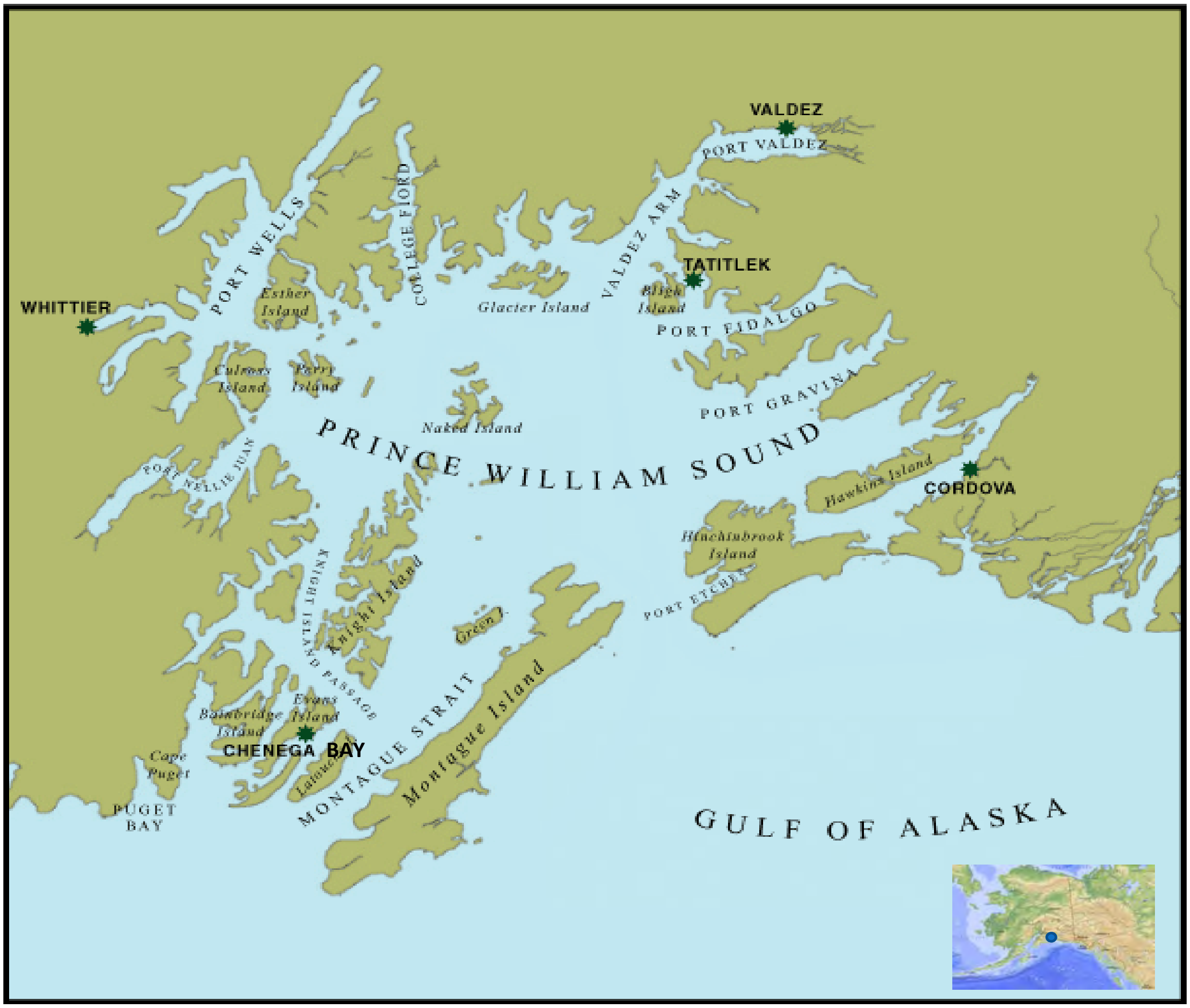
REGIONAL BACKGROUND

This chapter summarizes relevant physical, demographics and energy use characteristics of the Prince William Sound Region.

REGIONAL BACKGROUND

This plan considers five communities in Prince William Sound that are part of the PWSEDD service area: Chenega Bay, Cordova, Tatitlek, Valdez and Whittier. The largest is Valdez, the major hub community with approximately 4,036 residents. This planning effort does not include the communities of Seward, Port Graham, or Nanwalek, as these communities are included in the Alaska Railbelt Regional Integrated Resource Plan (RIRP) Study, completed in February 2010. The following sections provide additional information about the physical conditions, demographics, economy, housing, sanitation systems, transportation, planning, regional contacts and energy background in the communities under consideration.

Figure 1: Prince William Sound Region Planning Area



A. PHYSICAL CONDITIONS

1. LOCATION

The Prince William Sound region (shown in Figure 1) is located along the coast in Southcentral Alaska at the north end of the Gulf of Alaska, approximately 1,000 miles northwest of Seattle. This extremely mountainous area covers about 20,000 square miles of ocean, ice and land, extending from 250 miles west of Icy Bay on the east, to the eastern boundaries of the Municipality of Anchorage and Kenai Peninsula Borough on the west.

On the south, the area is bounded by the Gulf of Alaska, the southerly extreme being located at the southwestern corner of Montague Island. On the north, the area is traversed by section, township and range lines that cross the Richardson Highway near Mile 45.

2. PHYSICAL FEATURES

Prince William Sound is backed by the Chugach Mountains in its central and eastern portions, and by the Kenai Mountains at its western edge. The highest sections of the Kenai-Chugach Range consist of extremely rugged northeast trending ridges from 7,000 to 13,000 feet high. The lower sections consist of massive mountains five to ten miles wide and between 3,000 to 6,000 feet in height. All higher parts of the range are buried in ice fields that feed massive valley and piedmont glaciers. The coastline is deeply indented by drowned glacial valleys and there are numerous islands, particularly in the more westerly portions of the Sound. Like the mountain ridges, the major fjords and islands also trend in a northeasterly direction. The islands of Hawkins, Hinchenbrook, Montague, Latouche, Elrington and Bainbridge, separate the sound from the Gulf of Alaska. High coastal mountain ranges, over one hundred fifty glaciers, and numerous rivers make much of Prince William Sound wild and inaccessible (Cordova Hazard Mitigation Plan, WHPacific, Inc.).

Photo 1. Sitka Spruce in the Chugach Region
Source: U.S. Geological Survey

3. VEGETATION

The coastal areas of the region, especially the outer coast of the Kenai Peninsula, Prince William Sound, and the southern flanks of the Chugach and St. Elias mountains, are vegetated by maritime tundra, alder thickets, and coastal forests of Sitka spruce, mountain hemlock, western hemlock, and cottonwood. Areas with poplar and willows are also common.

4. MINERALS

In the Prince William Sound Region, copper and gold have been the chief mineral commodities. The notable mining districts have historically been Port Wells, Port Valdez, and Ellamar. The earliest record of gold production in the Prince William Sound region was in 1894 near Port Valdez. Gold production from this region reached its zenith before 1920.

Photo 2: Kennecott Copper Mill
Source: National Park Service

According to a 2008 landscape study performed by the Cordova Ranger District, the overall potential for mineral development to occur in the analyzed Prince William Sound Region is highly variable. The majority of the analysis area was delineated as “not favorable for future development of gold or copper resources.” A large linear area across the north edge of the analysis area was delineated as having “no identified mineral resources, but highly favorable [most favorable] for undiscovered resources,” as was an area extending north of Galena Bay from the private lands between Port Fidalgo and Valdez Arm. An area between Port Gravina and Port Fidalgo was delineated that "contains identified mineral resources, highly favorable [most favorable] for future mineral development." The potential for mineral materials or common variety mineral development on National Forest System lands is low due to the remote location of most of the analysis area (Agnew Beck Consulting, 2011).

5. OIL AND GAS

Oil and gas, along with mining, fishing and tourism, play an extremely important role in the state's economy as well as the Prince William Sound region. Alaska is the third largest oil producer in the nation and has been a leading producer for the past 30 years, producing 7% of the domestic supply in 2013 and employing over 20,000 oil and gas workers, or nearly 5% of the total Alaska workforce (Alaska Department of Labor, 2015). The oil and gas industry is particularly important in the Valdez area, the most populated city in the region. Since 1977, Valdez has served as the southern terminus and off-loading point for the Trans Alaska Pipeline, which transports almost all the crude oil in Alaska from the North Slope.

The lucrative oil industry in the Valdez area attracts many workers from both within Alaska and outside the state, which increases the demand for energy in the Prince William Sound Region. Four of the top ten employers in Valdez are directly connected to the oil industry. For instance, the Alyeska Pipeline Service Company in Valdez assigns employees to work in Valdez. Some of these employees live elsewhere and commute to Valdez for field schedule jobs. Likewise, residents from other Prince William Sound communities find employment at the southern terminus and off-loading point of the Trans Alaska Pipeline in Valdez.

6. CLIMATE

The Prince William Sound region lies in the maritime climate zone. This zone lacks prolonged periods of freezing weather at low altitudes and is characterized by cloudiness and frequent fog. The combination of heavy precipitation and low temperatures at high altitudes in the coastal mountains of southern Alaska accounts for the numerous mountain glaciers. The marine climate in the Prince William Sound Region is characterized by typical summer temperatures in the 60's (Fahrenheit) and winter temperatures between zero and twenty degrees Fahrenheit.

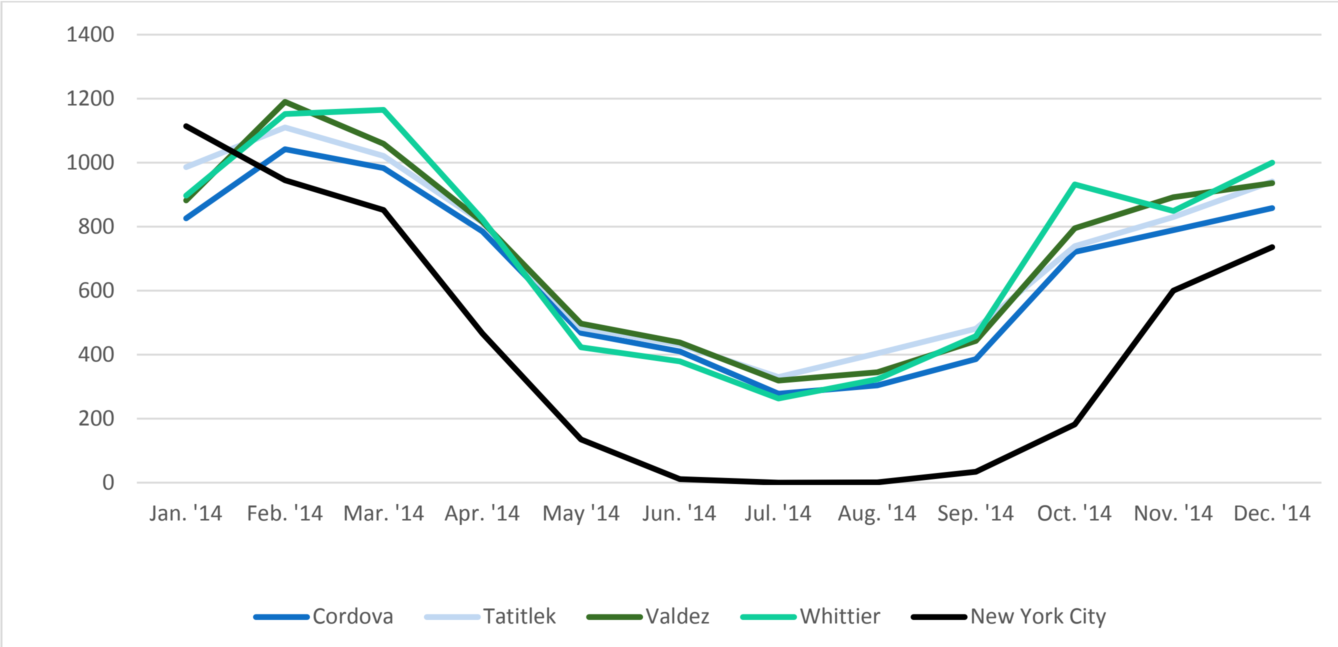
Residents report that the weather pattern has changed in recent years, with snowfall occurring earlier in the season but accumulating to significantly lower levels overall.

HEATING DEGREE DAYS

The outside temperature plays a big role in how much energy it will take to keep a structure warm. Heating degree days are one way of expressing how cold a location is and can help determine how much fuel might be required at the community level. Heating degree days are a measure of how much (in degrees), and for how long (in days), the outside air temperature was below a certain level. They are commonly used in calculations relating to the energy consumption required to heat buildings. The higher the number, the more energy will be required.

Exhibit 1 indicates average heating degree days for each month in communities in the Prince William Sound Region where that data is collected. New York's heating degree days, shown for comparison, indicate a warmer climate which lessens the need for energy to heat buildings. Only those communities with complete records are shown.

Exhibit 1: Heating Degree Days in Select Communities, 2014



Source: www.degreedays.net

WINDS

Prince William Sound (PWS) is located in the northern Gulf of Alaska (GOA). The Gulf of Alaska is dominated by a low pressure system. While relatively exposed to open ocean on its southern boundary, to the north, east and west, PWS is surrounded by a rugged, elevated, and highly glaciated mountain barrier. In the cold season, this barrier tends to separate the cold, dry interior continental air mass from the relatively warm, moist maritime air mass in the northern GOA. Frequently occurring low pressure systems in combination with the high terrain act to induce a variety of strong off-shore and along-shore local winds. In the cold season, the interior of Alaska often is dominated by high pressure near the surface, and PWS is dominated by relatively low pressure. Consequently, pressure gradients are maintained around PWS and gap flows are common in major gaps and fjords in PWS. The strength of these gap winds is strongly affected by the imposed pressure gradients. Strong pressure gradients often generate strong gap winds.

CLIMATE CHANGE

Climate change describes the variation in Earth's global and regional atmosphere over time. The impacts of climate warming in Alaska are already occurring. The effects of climate change can potentially exacerbate natural phenomena. Energy infrastructure will be vulnerable to more extreme weather events, rising sea levels, and thawing permafrost. Key threats include changes to sea levels, increased storm intensities, ocean acidification, warming ocean and stream temperatures, increased retreat of glaciers, changing precipitation amounts and patterns, changes to evapotranspiration rates, changing distributions of species, changing outbreaks of insects, changes to ecosystem productivity, and changing fire regimes.

The effects of climate change can potentially exacerbate natural phenomena. For example, melting permafrost contributes significantly to ground failure or destabilization of the ground in a seismic event. Changing weather patterns can cause unusual and severe weather. Marine or tidewater glaciers running into the ocean are at substantial risk due to climate change.

The following photo shows the extent of glacial melt between 1937 and 2006 on Yale Glacier in Chugach National Forest:

Photo 3. Yale Glacier in 1937 and 2006

Source: U.S. Geological Survey

Adapting to the impacts of climate change before they become critical is important to the long term safety and economic stability of the people of PWS, and to the security of the infrastructure supporting the region. Energy infrastructure will be vulnerable to more extreme weather events, rising sea levels, glacial melting, and thawing permafrost. Strategies for adaptation to climate change will need to be developed and continually updated as new information becomes available.

Increasing avalanche danger that may be related to warming temperatures is causing Copper Valley Electric Association (CVEA) to explore options for relocating the Thompson Pass Solomon Gulch Transmission Line. "After seeing only one destructive avalance in the line's first 19 years of existence, four damaging avalanches have occurred in the last 11 years." Extreme avalanches destroy electrical towers and can cause outages, requiring costly repairs and putting workers at risk. In the 2011 Thompson Pass Avalanche Mitigation Study for the Solomon Gulch 138 KV Transmission Line, CVEA recommends relocation of line on the east side of the Richardson Highway down to DOT&PF right of way or across the highway onto Alaska Department of Natural Resources Division of Land, Mining and Water (DNR) lands in the valley on the west side (Copper Valley Electric Association, June 2011).

The 2014 Assessment Report prepared by the United States Forest Service indicates that ten percent of watersheds in the Chugach National Forest may be vulnerable to climate change, as the watershed is increasingly characterized by more rain and less snow. This may cause significant variations in historical levels of salmon production, as well as impacts to other wildlife. The report does suggest that diversity within the National Forest will likely make the forest more resilient to impacts from climate change (United States Department of Agriculture, Forest Service, 2015).

Better baseline data is needed regarding impacts to hydrology from climate change in Chugach National Forest. Data is limited, and funding constrains the feasibility of data gathering efforts. Future data gathering will likely need to rely on partnerships with other agencies in order to maximize resources and provide good baseline information for future analyses (United States Department of Agriculture, Forest Service, 2015).

B. DEMOGRAPHICS

Demographics shape current and future energy demands. Understanding current demand can help to pinpoint inadequacies and identify opportunities for efficiency improvements. Projections of future energy use can help leaders to tailor improvements or new facilities to optimally meet community needs. While the region has been growing gradually, population trends for individual communities are more varied. This section provides an overview of current Prince William Sound Region demographics and future trends.

1. CURRENT POPULATION

Most of the residents in the Prince William Sound region live in the larger communities of Cordova (2,454 residents) and Valdez (4,036 residents), while the remainder of the residents in Chenega Bay, Tatitlek and Whittier live in communities with fewer than 200 people. According to the U.S. Census the 2010 population in the Prince William Sound Region was 6,865.

The population in the Prince William Sound Region is generally older than that of the rest of Alaska. At 38, the median age – or midpoint of the population – for the Prince William Sound Region is five years older than the median age of 33 for the state.

2. POPULATION TRENDS

It is difficult to determine the aggregate regional population trend in the Prince William Sound Region due to the sporadic rise and fall of the region's population. From 1980 to 2010, the population in the region decreased from 7,204 residents to 6,599 residents. Between 1990 and 2000, there was an increase of 231 people.

Major historical and natural events in the Prince William Sound Region have affected its population trends. For instance, the Exxon Valdez Oil spill in 1989, the largest single oil spill in U.S. coastal waters (until the 2010 Deepwater Horizon oil spill in the Gulf of Mexico) resulted in an unprecedented response and cleanup effort that temporarily tripled the population in Valdez.

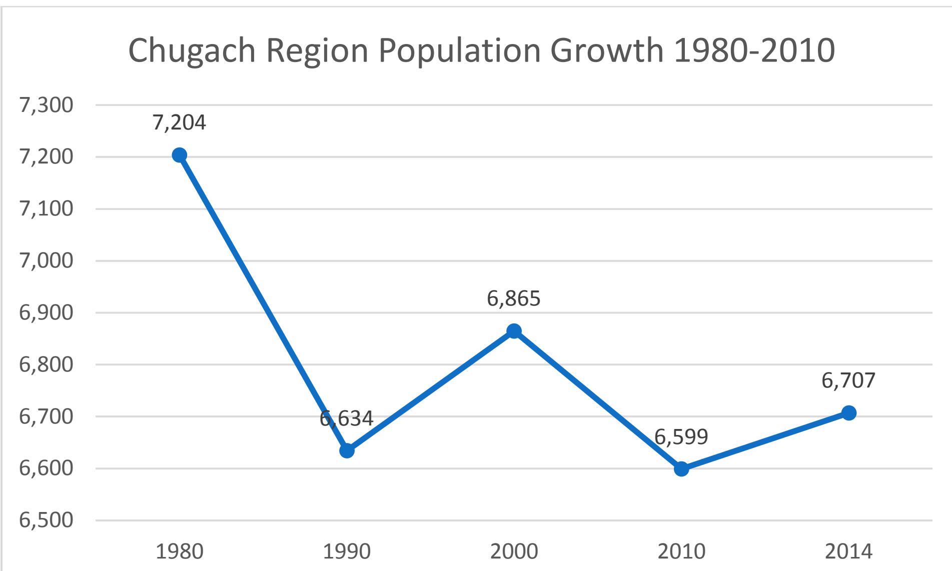
The region has experienced several similar fluctuations in population within the past 50 years (see Exhibit 2). From 2000 to 2010, the population lost 348 residents or a loss of about 5%. From 1990 to 2014, the region experienced annual growth rate of less than one percent. Assuming this population trend continues, the population would reach approximately 6,800 by 2025.

Table 1: 2000-2010 Population in Communities in the Prince William Sound Region

Community	2000 Census	2010 Census	Percent Change 2000 to 2010
Chenega Bay	92	76	-7.3
Cordova (Including Eyak)	2,622	2,239	-14.6
Tatitlek	108	88	-17.8
Valdez	4,036	3,976	-6
Whittier	182	220	20.9
TOTAL	**6,947**	**6,599**	**-5.0**

Source: PWSEDD, 2011-2016 Comprehensive Economic Development Strategy

Exhibit 2: Prince William Sound Regional Population Growth 1980-2010



Source: U.S and DCRA Census data

C. ECONOMY

Key components of the economy in the Prince William Sound region are oil and gas, fishing, tourism and transportation. Energy is also an important aspect of the economy.

Oil and Gas – The southern terminus and off-loading point for the Trans-Alaska Pipeline is located at Valdez. This facility provides transportation for the North Slope oil, petroleum industry. This facility is the main reason that Valdez has the highest average annual wage in the region. Four of the top ten employers in Valdez are directly connected to the oil industry. Residents from other parts of the region also work at the terminal and some employees live elsewhere and commute to Valdez for jobs. There are also a significant number of contractors that support operations at the terminals (PWSEDD, 2011).

Fishing – Fishing has been a significant part of the economy in the Prince William Sound for over a century. The commercial fishing industry has fluctuated but in 2006, processors, commercial fishermen and sport fishing service businesses earned an estimated $82 million from salmon in the Valdez-Cordova area (not counting Solomon Gulch Hatchery, Copper River salmon fishery, halibut or shellfish) (PWSEDD, 2011).

Tourism and Transportation – Tourism businesses and employment in the region include lodging, food, transportation and related services in the region's communities. There are a handful of small fishing lodges scattered around the Sound, and day activities like sportfishing charters, sightseeing cruises and flightseeing, and overnight cruises. A related, important part of the region's tourism economy is the set of support services provided to visitors, including ferry and plane service, kayak drop-off, rentals, and fuel sales.

Energy – Energy plays a significant role and barrier to economic growth in the region. Fuel costs impact fishing, tourism and other parts of the economy. The number of workers associated with energy jobs is significant. The 2011 Community Economic Strategy for the region recommends investing in renewable energy to increase jobs and decrease dependence on fuel. The Strategy also encourages participation in a bulk fuel cooperative to partner and buy fuel in bulk and help stabilize costs.

D. HOUSING

1. Regional Housing Assessment

The 2014 AHFC Alaska Housing Assessment used a variety of sources to analyze statewide and regional housing. Their summaries are organized by ANCSA Native Corporations. Below is a summary of the assessment for houses in the Chugach Alaska Region.[1]

Housing Units: There are currently 5,844 housing units in the Chugach Alaska Corporation ANCSA region. Of these, 4,555 are occupied, 289 vacant units are for sale or rent, and the remaining 1,000 are seasonal or otherwise vacant units.

Energy: The average home in the Chugach Alaska Corporation ANCSA region is 1,804 square feet and uses 128,000 BTUs of energy per square foot annually. This is seven percent less than the statewide average of 137,000 BTUs per square foot per year.

Energy Costs: Using AKWarm estimates, average annual energy cost for homes in the Chugach Alaska Corporation ANCSA region is $7,740, which is approximately 2.8 times more than the cost in Anchorage, and 3.6 times more than the national average.

Energy Programs: Approximately 15% of the occupied housing units in the Chugach Alaska Corporation ANCSA region have completed the Home Energy Rebate or Weatherization programs, or have received BEES certification since 2008, compared to 21% statewide. AHFC performed public building energy audits for the Cordova Community Medical Center and the Cordova Jr./Sr. High School.

[1] Note that this summary includes Nanwalek, Port Graham and Seward which are not part of the Chugach energy region. Eyak is included as part of Cordova.

Housing Quality: Within current housing stock, newer homes have better energy performance. On average, homes built in the 1940s are currently rated at 1-star-plus compared to a current average rating of 4-star-plus for homes built after 2000.

Air-tightness: Within current housing stock, newer homes are tighter. On average, homes built in the last decade exceed the 2012 BEES standard of four air-changes per hour at 50 Pascals. In contrast, homes built before 1940 are four times leakier than those built since 2000.

Ventilation: An estimated 2,305 occupied housing units (or 51%) in the Chugach Alaska Corporation ANCSA region are relatively air-tight and lack a continuous ventilation system. These houses are at higher risk of moisture and indoor air quality-related issues.

Overcrowding: Six percent of occupied units are estimated to be either overcrowded (5%) or severely overcrowded (1%). This is roughly two times the national average.

Affordability: According to American Community Survey (ACS) data, approximately 23% of households in the Chugach Alaska Corporation region spend 30% or more of total income on reported housing costs, including rent, water and sewer utilities, and energy costs. Using AKWarm estimates, the region's average annual energy costs constitute approximately 12% of census median area income for occupied housing.

2. HOUSING ORGANIZATIONS

North Pacific Rim Housing Authority (NPRHA) – North Pacific Rim Housing Authority is an Indian Housing Authority authorized by state law to engage in or assist in the development of low-income housing for Alaska Native/American Indian families.

NPRHA's region is comprised of seven communities, including Chenega Bay, Cordova, Tatitlek, and Valdez.[2] NPRHA provides safe, sanitary and affordable housing for tribal members and members of the Native Community, promotes responsible home ownership, rental units, transient housing, elder housing and other special needs housing and community programs, and develops and manages housing based upon community needs. The NPRHA has constructed over 175 homes through its Mutual Help Homeownership Program. It also provides an Affordable Rental Program to offer low-income Native residents low rent housing as well as rental housing for elderly and the handicapped persons. NPRHA assists communities with development and renovation of community facilities and are the weatherization provider for Chenega and Tatitlek and for NPRHA developed homes in Valdez and Cordova.

Cold Climate Housing Research Center (CCHRC) – The Cold Climate Housing Research Center is an industry-based nonprofit corporation created to facilitate the development, use, and testing of energy-efficient, durable, healthy, and cost-effective building technologies for people living in cold climates. CCHRC offers services in Building Science Research, Sustainable Northern Communities and Policy Research.

[2] The remaining NPRHA communities (Seward, Nanwalek and Port Graham) are not considered in this plan.

E. SANITATION

1. SEWER AND WATER

Most of the homes in the Prince William Sound Region are served with piped water and sewer services. Piped water and sewer systems can consume large amounts of energy. The water systems in Cordova, Valdez, and Whittier are owned by their municipal governments, while the water systems in Chenega Bay and Tatitlek are owned by their local Tribal entity (IRA councils).

Table 2: Sanitation Systems in the Prince William Sound Region

Community Name	Water System Type	Wastewater System/Type (Sewer)	Wastewater Type	Utility Owner
Chenega Bay	Groundwater well	Backhaul sludge to Valdez disposal site	Piped	IRA Tribe
Cordova	Surface water	Wastewater Treatment System	Pump/Piped	City of Cordova
Tatitlek	Piped	Wastewater Facility	Piped	IRA Council
Valdez	Pressure	Wastewater Utility	Gravity	City of Valdez
Whittier	Groundwater well	Wastewater Treatment Facility	N/A	City of Whittier

Source: DCRA

2. LANDFILLS

Cordova, Valdez and Whittier are all permitted. Cordova and Valdez both have Class III facilities, while Whittier has a Class I facility. Chenega Bay and Tatitlek both have unpermitted Class III facilities. PWSEDD completed a Solid Waste Management Plan (SWMP) in 1997. Funded by the Exxon Valdez Oil Spill Trustee Council to eliminate pollution in Prince William Sound, waste handling facilities were constructed in each of the five communities in the Sound. These facilities act as collection centers for oily bilge water and other hazardous waste. The bilge water, once filtered, is safely returned to the sea. The reclaimed oil is used to heat public buildings in the communities.

F. TRANSPORTATION

The economic health and long-term sustainability of Prince William Sound communities rely heavily on a multi-modal system of transportation infrastructure. Prevalent modes of transportation in the Prince William Sound Region include airports, roads, ferries, private boats, ports, barge landings, trails and roads for transportation to, from, and within the region.

While roads reach Valdez and road and rail extend to Whittier, the vast majority of the land and water in the Sound is far removed from the closest highway. As a result, nearly all tourists and residents traveling to and within Prince William Sound rely on means other than automobiles. Though Valdez is on the road system, it is 300 miles away from Anchorage by road and only 115 air miles away. Travel to Valdez is generally more efficiently done by airplane. Access to Chenega Bay, Cordova and Tatitlek is limited to air and water. Inclement weather frequently delays travel.

Several large scale transportation projects have increased access to and within the region. These include the opening of the Whittier Tunnel in the year 2000, the change in cruise ship dockings to include Whittier (2004) and the addition of a fast ferry in the Sound in 2006.

Whittier, Valdez and Cordova also accommodate cruise ships. Whittier has a dock that can accommodate large ships while Valdez and Cordova receive visits from smaller cruise ships. Traffic also arrives at Whittier and Valdez by road. The majority of people arriving via cruise ship and train are visitors. The traffic arriving by plane, ferry and road is made up of both visitors and residents.

Photo 4. Alaska Marine Highway

Source: Alaska.org

G. PLANNING

Several efforts have been made in the region to take steps to improve energy efficiency and develop energy infrastructure. However, many of these approaches have been conducted on the community level and were not part of a larger, coordinated effort that could benefit multiple communities. One exception is the Comprehensive Economic Development Strategy for 2011 – 2016 completed by PWSEDD, which identifies and defines Prince William Sound economic clusters and regional and local projects that support these clusters (2011-2016 Comprehensive Economic Development District - PWSEDD).

Local plans include:

Chenega Bay

- Chenega Bay Master Plan (2008)
- Community of Chenega Comprehensive Economic Development Strategies (2008)

Cordova

- City of Cordova 2008 Comprehensive Plan (2008)
- Cordova Economic Development Strategy 1997 (1997)
- Cordova Local Hazard Mitigation Plan (2013)

Tatitlek

- Native Village of Tatitlek Community Strategic Plan (2001)

Valdez

- Local Hazard Mitigation Plan (2007)

- Valdez Comprehensive Plan (2007)

Whittier

- Whittier Comprehensive Plan (2005)
- Local Hazard Mitigation Plan (2005)

These plans are available for review at Department of Commerce, Community and Economic Development (DCCED) Planning and Land Management Community Plans Library Search page (http://commerce.state.ak.us/dnn/dcra/PlanningLandManagement/CommunityPlansLibrary.aspx).

H. REGIONAL CONTACTS

The following table provides contact information for entities serving the Prince William Sound Region as a whole:

Table 3: Regional or Subregional Entities Serving the Prince William Sound Region

Organization	Contact Information
Alaska Regional Development Organization	Prince William Sound Economic Development District 2207 Spenard Road, Suite 207 Anchorage, AK 99503 Phone: 907-222-2440 Fax: 907-222-2411 Website: http://pwsedd.org/
Electric Utilities	Chenega Bay Utilities P.O. Box 8079 Chenega Bay, AK 99574 Phone: 907-573-5132 Email: tking@chenegafuture/com
	Cordova Electric Cooperative, Inc. P.O. Box 20 705 Second Street Cordova, AK 99574 Email: info@cordovaelectric.com Website: http://cordovaelectric.com/
	Tatitlek Electric Utility P.O. Box 171 Tatitlek, AK 99677 Phone: 907-325-2311 Fax: 907-325-2298
	Copper Valley Electric Association, Inc. 359 Fairbanks Street Valdez, AK 99686

	Phone: 907-835-4301 Fax: 907-835-4328 Email: gallatin@cvea.org
	Chugach Electric Association 5601 Electron Drive P.O. Box 196300 Anchorage, AK 99519-6300 Phone: 907-563-7494 Email: service@chugachelectric.com Website: http://www.chugachelectric.com/
Native Corporation	Chugach Alaska Corporation 3800 Centerpoint Drive, Ste. 700 Anchorage, AK 99503-4396 Phone: 907-561-2668 Fax: 907-562-5258 Email: randi.gause@chugach-ak.com Website: http://www.chugach-ak.com
Native Non-Profit	Chugachmiut 1840 Bragaw Street, Suite 110 Anchorage, AK 99508-3463 Phone: 907-562-4155 Fax: 907-563-2891 Website: http://www.chugachmiut.org
Regional Housing Authority	North Pacific Rim Housing Authority 8300 King Street Anchorage, AK 99518 Phone: 907-562-1444 Fax: 907-562-1445 Website: http://www.hprha.com
School Districts	Chugach School District 9312 Vanguard Drive Suite 100 Anchorage, AK 99507 Phone: 907-522-7400 Fax: 907-522-3399 Email: bcrumley@chugachschools.com Website: http://www.chugachschools.com
	Cordova School District 675 Second Street P.O. Box 1330 Cordova, AK 99574 Phone: 907-424-3265 Fax: 907-424-3271 Website: http://www.cordovasd.org

	Valdez City School District 1112 West Klutina Street P.O. Box 398 Valdez, AK 99686 Phone: 907-835-4357 Fax: 907-835-2047 Website: http://www.valdexcityschools.org

I. ENERGY BACKGROUND

1. UTILITIES

Energy services are provided to all the region's communities. Local utility services such as water, sewer, and solid waste disposal in the Prince William Sound Region are provided by their municipal governments. Electric utilities in Cordova, Valdez and Whittier are provided by Electric Cooperatives or Associations. In Chenega Bay and Tatitlek, the electrical utility services are owned and operated by their IRA councils as shown in Table 4.

Table 4: Electrical Utilities in Prince William Sound Region

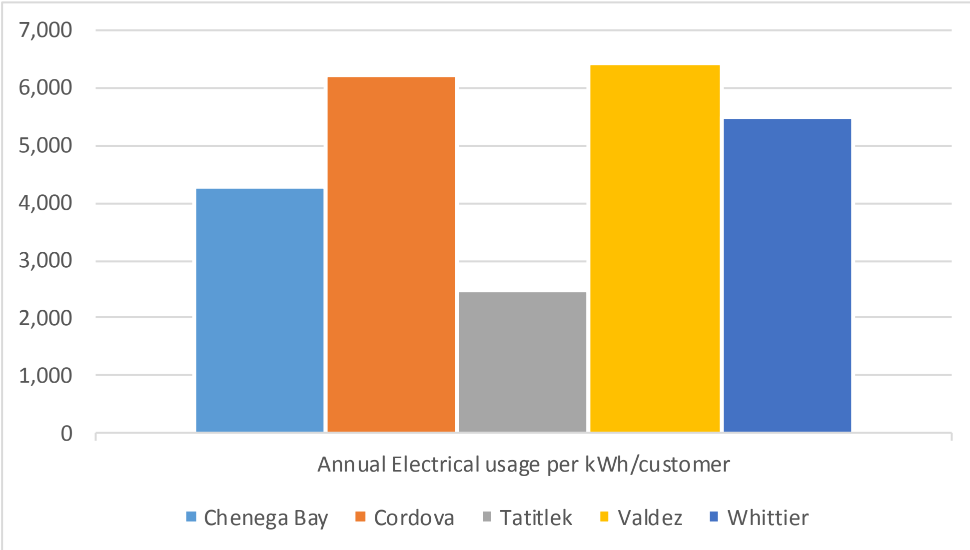
Community	Electric Utility
Chenega Bay	Chenega IRA Council
Cordova	Cordova Electric Cooperative
Tatitlek	Tatitlek IRA Council
Valdez	Copper Valley Electric Cooperative
Whittier	Chugach Electric Association

2. ELECTRICITY

ELECTRIC USAGE

Measurements of the average community-wide residential kWh usage per customer show that Tatitlek - followed by Chenega Bay – uses the least amount of electricity. Valdez, Cordova and Whittier have the highest rates of use, as shown in Exhibit 3.

Exhibit 3: Average Annual Residential kWh Electricity Used



Source: 2014 PCE Reports, Chugach Electric, Copper Valley Electric Association

ELECTRIC RATES

The Prince William Sound region's consumer's electric rate is generally higher than the state average electrical rate of 20 cents per kWh (Melendez, 2012). The rates vary depending on the size of the commercial operation and the amount of kWh used. Average residential electrical rates range from 14 cents a kWh (Whittier) to $.87 kWh (Tatitlek). Valdez also has a low rate in the summer months of 18 cents. The following table provides information about the electrical rates in each community, including information about the Power Cost Equalization (PCE) subsidy for eligible communities. The PCE rate is described in more detail in the next section.

Table 5: Prince William Sound Region Residential Electric Rates

Community Name	Cost per kWh	
	Without PCE	With PCE
Chenega Bay	$.67	$.17
Cordova	$.39	$.25
Tatitlek	$.87	$.34
Valdez	$.18 summer $.24-.28 winter	N/A
Whittier	$.14	N/A

POWER COST EQUALIZATION

The Power Cost Equalization (PCE) program was created in 1985 as part of a statewide energy plan. The intent of the program was to provide economic assistance toward energy costs to residents of rural Alaskan communities not on the road system. The rationale for the program is that rural consumers often pay three to five times the rate of urban consumers, and do not reap the benefit of large state-subsidized energy infrastructure projects completed in urban areas. The PCE program was a way to extend benefits to far flung communities through rate relief (Alaska Energy Authority, 2013).

The AEA and the Regulatory Commission of Alaska (RCA) both receive reports from utilities that detail electrical statistical data by community. Utilities also submit fuel reports to RCA on schedules based on how often they get fuel delivered. RCA uses these to update PCE levels as fuel costs change. AEA reports are provided monthly, and utilities deliver an annual report to RCA. RCA uses that annual report to calculate the PCE rate using both fuel and non-fuel rates. RCA provides the rate to the AEA.

The PCE program subsidizes an average of about 39 cents per kWh up to 500 kWh per month for the eligible communities, which include Chenega Bay, Cordova and Tatitlek.

3. PROPANE

Propane can be a cost effective choice for household use, such as for cooking. In the early '80s when electricity costs were high, more residents used propane for cooking. Over time, propane-fired appliances were replaced by electrical appliances and by the early 2000s, the number of propane appliances had dropped significantly. Copper Valley Telecom transports propane by helicopter to power their three remote telecommunication sites in the region. There are many advantages to propane over diesel, such as the following:

- Propane and natural gas can be used in many of the same appliances and facilities, without major modifications.
- Propane condenses to a liquid under relatively little pressure, so it can be transported more easily by truck or barge than natural gas.
- Propane reverts to a gas when released from pressure, so spills are not a problem, as they are with fuel oil.
- Propane burns cleaner than fuel oil.

Disadvantages of propane are that it takes more space to transport and store than an equivalent amount of energy in fuel oil. Liquid propane produces less energy, per gallon, than fuel oil (132,000 Btu/gal versus 92,000 Btu/gal). Propane requires pressurized storage tanks, and more of them. Another disadvantage is that because propane is heavier than air, it can be a fire threat if accidentally released. Residential propane tanks and lines need to be well-insulated from the cold, because at very cold temperatures, propane turns from gas to liquid, meaning whatever was fueled by the propane would stop working. The cost of propane in the Prince William Sound Region ranges from $107 to $386 per 100 pounds for residents as shown in Table 6. This compares with a cost in Anchorage of $106 per 100 pounds.

Table 6: Prince William Sound Region Propane Costs by Community

Community	Propane $/100# ob bottle
Chenega Bay	$386.43
Cordova	$118.43
Tatitlek	N/A
Valdez	$107.14
Whittier	$112.62

4. FUEL

Transportation costs contribute to the cost of fuel in the region, particularly for the communities off the road system. Using 2013/2014 costs, diesel fuel ranges from $4.04 in Whittier to $7.22 in Chenega Bay. Gasoline costs range from $3.32 to $5.03.

Table 7: 2014 Fuel Rates in the Prince William Sound Region

Community	Diesel $/gallon	Gasoline $/gallon
Chenega Bay	$7.22	N/A
Cordova	$4.62	$5.03
Tatitlek	$5.43	N/A
Valdez	$4.13	$4.47
Whittier	$4.05	$3.32

"The cost of energy has been and continues to be a barrier for economic development for the residents of Prince William Sound."

Prince William Sound CEDS, 2011-2016

5. OIL AND GAS

Photo 5. Chilkat Oil Refinery near Katalla, Operating from 1911-1933
Source: University of Alaska, Fairbanks Archives

In September 1902, oil was discovered at Katalla, located 47 miles southeast of Cordova near the mouth of the Bering River, about 15 miles from actively producing coal fields. This was the first discovery of commercial quantities of oil in Alaska. Soon oil derricks, drilling equipment, cabins and pipelines were erected and a small town was formed. Within a short time the population of Katalla had risen to nearly 5,000. Several oil companies were drilling to find additional oil but many of the results were disappointing. By 1931, some 44 test wells had been drilled, 28 of which were within the Katalla field. Of those, 18 produced oil, which was refined and sold locally. On Christmas Day 1933, a fire destroyed the Chilkat Oil Company's refinery, and operations ceased (Jessup, 2005). Its total production was 154,000 bbl of oil.

Today, oil and gas activity in the region takes place primarily in Valdez, the southern terminus and off-loading point for the Trans Alaska Pipeline, which transports almost all the crude oil in Alaska from the North Slope.

6. NATURAL GAS

Enstar Natural Gas Company provides natural gas to Whittier, but none of the other communities in the Prince William Sound region have access to natural gas.

CHAPTER 3

Regional Energy Analysis

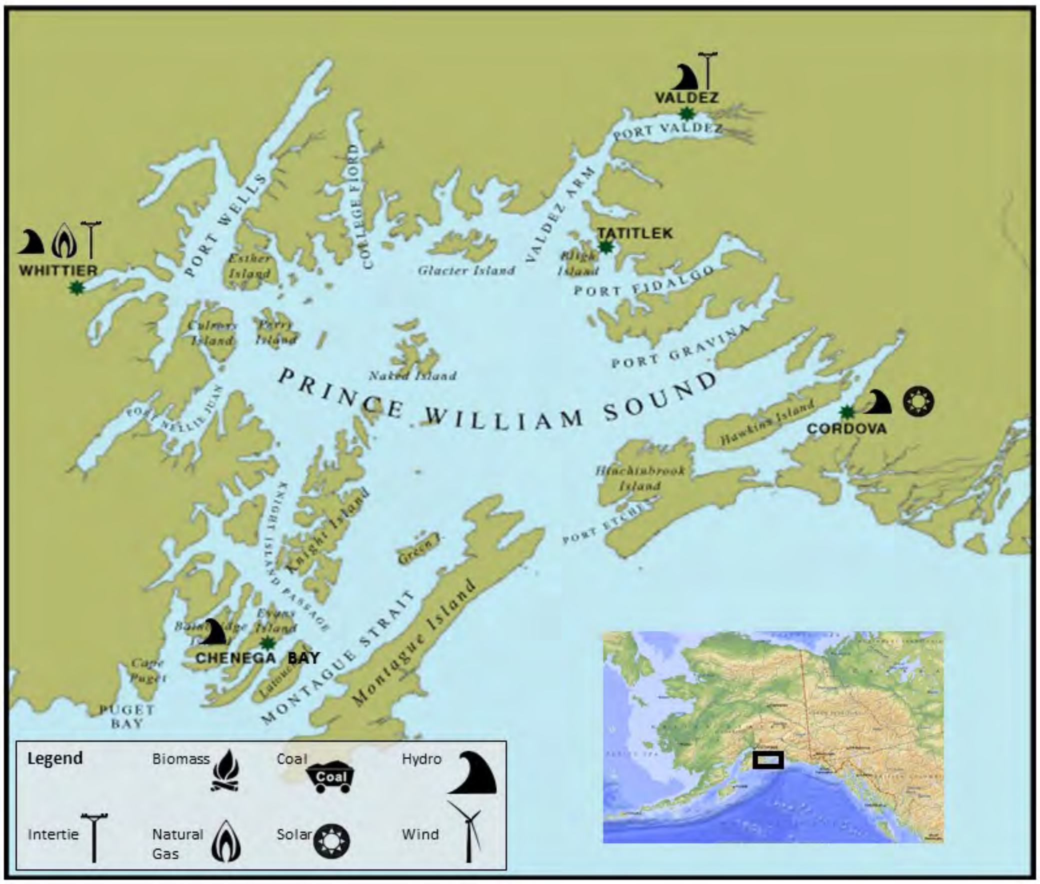
REGIONAL ENERGY ANALYSIS

This chapter provides details about potential energy resources and energy efficiency opportunities in the Prince William Sound Region and outlines regional priorities.

The following sections describe the potential energy resources and energy efficiency opportunities in the region, along with descriptions of regional priority energy projects proposed or already underway.

The map below shows the renewable resources for each community currently being used, not including heat recovery. Cordova and Tatitlek are both using waste heat from their power plants.

Table 8 Renewable Resource Map



A. ENERGY RESOURCES

1. OIL AND GAS

With the exception of the Katalla field, generally the Prince William Sound Region is underlain by igneous, metamorphic, or thermally over mature sedimentary rocks that geologists do not consider capable of containing exploitable accumulations of oil and gas (Swensen, Robert F., et. al, 2012).

2. COAL

In 1896, prospectors discovered coal in the Bering River area near Bering Glacier. The site lies between Icy Bay and the mouth of the Copper River area, about 12 miles from the Katalla oil fields and about 50 miles southeast of Cordova. Known coal bearing rocks are exposed in a belt about 21 miles long and two to five miles wide. This coal field contains bituminous coal, much of which was determined to be soft and crushed or greatly disturbed, thus making the coal fields more suitable for small mine operations as opposed to large commercial operations capable of large-scale sustainable coal exports.

Photo 6. Kushatka Lake, looking out over the Bering River Delta
Source: Ground Truth Trekking

Also nearby is Carbon Mountain, which contains one of the only anthracite deposits in the state. The protection or exploitation of these coal fields has been a contentious issue for many years. Currently, they are owned by a Korean company. The company was asked to retire mining rights on the land in 2011, for which the firm asked a price of $15.8 million. Currently, the Eyak Preservation Council and others are working to purchase and preserve this land (US Forest Service, 2015).

3. GEOTHERMAL

There are currently no geothermal energy projects in operation or under development in the Prince William Sound Region and the potential for geothermal development is considered low (REAP, 2015).

4. HYDROELECTRIC

Hydroelectric power, Alaska's largest source of renewable energy, supplies 21 percent of the state's electrical energy in an average water year (Alaska Energy Authority, 2011). In the Prince William Sound region, hydroelectric power is currently being used to generate power, particularly in Cordova and Valdez. Cordova Electric operates two run-of-the-river hydroelectric power projects, one at Power Creek and the other at Humpback Creek. Valdez operates a hydroelectric project at Solomon Gulch, and is currently constructing a run-of-the river hydropower project at Allison Creek.

The Power Creek Dam project provides half of Cordova's power. It was constructed in 1997 and is operated by Cordova Electric. The project consists of a diversion dam and intake structure, a tunnel-and-pipeline power conduit conveying water approximately 5,700 feet, and a power house with two generating units with a total installed capacity of 6 MW. A seven mile-long buried and submarine transmission line and two miles of access road connect the project to Cordova.

Cordova Electric also operates the Humpback Creek hydroelectric project. It includes a dam diversion structure that ponds water 174 feet above the power plant. A tunnel-and-pipeline power conduit conveys water 1,900 feet to a power house. A 17,000 foot underground and submarine transmission line delivers power from the project to a landing at the northern limit of the Cordova road system.

Photo 7. Solomon Gulch Hydroelectric Plant
Source: Copper Valley Electric

In 1982, Solomon Gulch hydroelectric facility located on Dayville Road in Valdez began producing power. It has an installed capacity of 12 MW. CVEA also has a 138-kilovolt transmission line from the Solomon Gulch hydroelectric facility 106-miles over Thompson Pass to the Copper Basin district during the summer months. The transmission line traverses severe terrain between the two districts, and sections of the line located in Thompson Pass have severe avalanche risk. The transmission line was last damaged by an avalanche in December 2009. CVEA is currently going through the process to relocate part of the transmission line.

In November 2014, CVEA completed the first construction season of the Allison Creek hydroelectric project. Commissioning of the 15 million kWhs facility is anticipated in 2016. Once complete, CVEA expects its annual benefits to include displacement of 725,000 gallons of fuel and elimination of 12,000 tons of carbon dioxide. They also expect a reduction of annual fuel costs by $2.415 million and a savings to its members of over $800,000 in the first year.

Cordova Electric Cooperative (CEC) and the City of Cordova (COC) also is in the process of developing a hydroelectric project at Crater Lake, located 2.5 miles northeast of Cordova. In 2015, AEA recommended that the Crater Lake project receive feasibility/design funding. The feasibility/conceptual design report for the Crater Lake Water & Power Project was completed in January 2016 by McMillen Jacobs Associates. The results prove that this project would benefit both CEC and COC.

The Native Village of Chenega Bay applied for AEA Renewable Energy funding (round 8) to construct a run-of-the-river hydroelectric project in Anderson Creek. Funding was denied because permits, land use authorization, construction ready design and specifications, final design cost estimate and an updated business plan needed to be completed prior to consideration for construction funding. Another hydro project in the early phases is the Tatitlek Wind/Hydro project.

5. BIOMASS

Alaska's primary biomass resources are wood, sawmill, wastes, fish byproducts and municipal waste. Generally, the potential for using biomass is medium to high in this region due to the abundance of forest resources, however land ownership presents challenges.

Photo 8. Old Log Deck on Eyak Corp. Land
Source: Eyak Feasibility Assessment for Biomass Heating

Almost all the high value forest resources in Prince William Sound are located on private land or on land managed by the U.S. Forest Service (USFS). The USFS does not have an active timber program in the area, except for allowance for personal use. Some lands are also locked up in conservation easements or were acquired for habitat protection as part of the Exxon Valdez settlement (Alaska Department of Natural Resources, 1999).

In 2008, the Eyak Corporation purchased a wood cord processing unit to assist with processing timber for biomass use. The unit is best suited for logs as opposed to poplar and willow that is common in the area. In 2009, they completed a feasibility study to examine if Cordova could effectively use the community's waste wood and cardboard to offset petroleum oil for heating purposes in community buildings. The report concluded:

> "Although the literal answer is that it is technically possible to divert waste wood and cardboard for use as fuel in a heat-producing boiler, the practical answer is that since Cordova is a relatively small community, it does not appear that sufficient volumes of clean, dry, useable feedstock can be generated in the form of waste wood and cardboard, used pallets, etc. to justify the costs of equipment and facilities for processing and storing the feedstock, the capital costs of boiler and emission control systems, and the infrastructure costs to distribute valuable heat to community buildings."

The report did suggest if the community were willing to include access to a sustainable source of forest feedstock resources, there would be additional options, the most promising of which was to use wood to generate heat to offset heating oil. Due to ownership issues of the high value timber in the region, this is problematic.

6. WIND

Wind power is designated into classes ranging from one to seven (see the following table). Class 4 or greater are generally considered to be suitable for most wind turbine applications. Class 3 areas are suitable for wind energy development using tall (e.g., 50 meter hub height) turbines. Class 2 areas are marginal and Class 1 areas are unsuitable for wind energy development (AWS Scientific, 1997).

Table 9. Classes of Wind Power Density

	30 m (98 ft)		50 m (164 ft)	
Wind Power Class	Wind Power Density (W/m²)	Wind Speed m/s (mph)	Wind Power Density (W/m²)	Wind Speed m/s (mph)
1	≤160	≤5.1 (11.4)	≤200	≤5.6 (12.5)
2	≤240	≤5.9 (13.2)	≤300	≤6.4 (14.3)

	30 m (98 ft)		50 m (164 ft)	
Wind Power Class	Wind Power Density (W/m²)	Wind Speed m/s (mph)	Wind Power Density (W/m²)	Wind Speed m/s (mph)
3	≤320	≤6.5 (14.6)	≤400	≤7.0 (15.7)
4	≤400	≤7.0 (15.7)	≤500	≤7.5 (16.8)
5	≤480	≤7.4 (16.6)	≤600	≤8.0 (17.9)
6	≤640	≤8.2 (18.3)	≤800	≤8.8 (19.7)
7	≤1600	≤11.0 (24.7)	≤2000	≤11.9 (26.6)

Source: Wind Resource Assessment Handbook, National Renewable Energy Laboratory

The wind speeds and directions were measured in several Prince William Sound region communities using anemometers for the wind speed, and wind vanes for the direction. The following wind resources were identified for communities in the region:

Table 10. Wind Class in Prince William Sound Regional Communities

Community	Wind Class	Information Source
Chenega Bay	6	Alaska Energy Community Model, 2009
Cordova	4	Eyak Wind Energy Feasibility Study
Tatitlek	1	Tatitlek Renewable Energy Resource Assessment, 2011
Valdez	1	AEA Wind Energy Analysis Data, Station Summary
Whittier	3	AEA Wind Energy Analysis Data, Station Summary

Currently, Copper Valley Telephone Cooperative, Inc. is using wind to supplement their diesel generator with a 7.5 kWh wind turbine at a remote site on Hinchinbrook Island. The winds at that site measure an average wind speed of 13 mph.

7. SOLAR

Challenges to using solar energy in Alaska are its seasonal variability and its dependence on weather conditions. In general, the solar resource is most abundant in the summer, when it is least needed. However, there is a reasonable resource available for seven to eight months of the year for all but the most northern areas of the state. Direct heating and daylighting with the sun require minimal technology, but they rely on good building design to prevent overloading in the summer months and to promote energy gathering during the shorter days closer to the winter season.

Recent installations throughout the northern latitudes indicate that despite the long, dark winters, solar power can offset energy costs, particularly in the spring when the sun reflects off the snow. Solar power is seen to be most appropriate in Alaska for smaller applications. In the Prince William Sound region, there are some examples of successful small solar applications. The Copper Valley Telephone Cooperative is using solar panels to offset their diesel use at three remote sites in the region.

8. TIDAL AND WAVE ENERGY

With an extensive coastline and strong tidal currents, Alaska has considerable potential for generation of energy from tidal and wave energy. Tidal energy is converted to electricity using dams that force water through turbines at high and low tides, and by underwater turbines that function during tidal flows. Commercial facilities using this technology are operating in France and Ireland. Wave energy is generated by wind-driven waves that move connected sections of a generator to produce electricity. A commercial wave energy production site is operating in Portugal, and there are plans underway for additional sites off the coasts of Italy, Spain, South Africa, Scotland and Oregon.

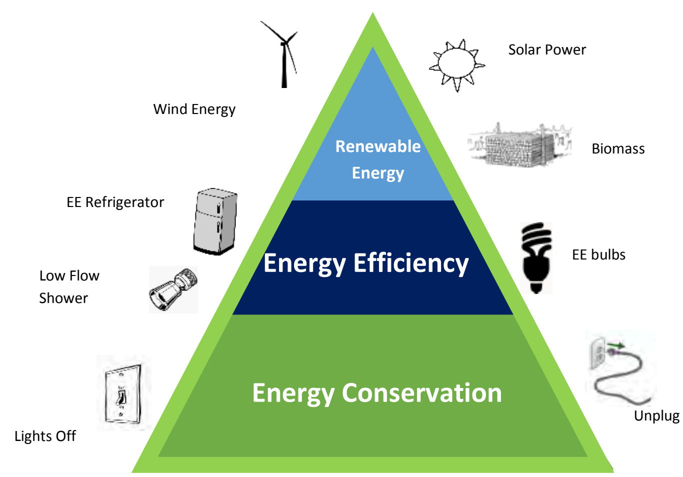
Although the potential is great, harnessing this energy in Alaska is made more difficult by the remote locations of viable sites and the prevalence of extreme storms that could make access difficult and maintenance frequent. Due to the distance of high wave locations from population centers, tidal energy is the approach most likely to be feasible in Alaska. Sites for tidal energy generation in Cook Inlet are under development near Nikiski and at Fire Island. Permitting is underway for a tidal energy project in Gastineau Channel near Juneau, a feasibility study is in development for a pilot project in Yakutat, and several other Southeast Alaska locations may be considered as future tidal energy sites. Members of the stakeholder group have indicated an interest in exploring the potential of this developing technology for use in Prince William Sound (Coil, David, Niki Hoagland and Bretwood Higman, 2012) (REAP, 2014) (Ocean Renewable Power Company, 2015).

9. ENERGY EFFICIENCY AND CONSERVATION

Energy efficiency and conservation (EE&C) measures can result in significant savings on heating and electricity costs for both residential and non-residential buildings. "Energy conservation" and "energy efficiency" are often used interchangeably, but there are some differences. Energy conservation means using less energy and is usually a behavioral change, such as turning lights off or unplugging a coffee maker when not in use. Energy efficiency means using energy more effectively, and is often a technological change, such as replacing light bulbs with more energy efficient light bulbs or replacing old refrigerators with more energy efficient refrigerators. Using renewable energy is another way to reduce dependence on non-renewable energy. These concepts are illustrated in Exhibit 4.

Since space and hot water heating account for over 80% of home energy budgets statewide (and around 55% of energy used in public and commercial buildings), EE&C improvements provide one of the best ways to address total energy costs.

Exhibit 4: Energy Pyramid



Source: WHPacific, Inc.

- *RESIDENTIAL BUILDINGS*

The 2014 Alaska Housing Assessment contains housing and energy data primarily collected through the AHFC Home Energy Rebate (HER) and Weatherization (Wx) programs. While the data quality for some communities is poor (based on the number of energy audits performed), it is possible to get a picture of residential energy use and costs at a regional level.

In 2010, there were approximately 4,555 occupied housing units within the greater Prince William Sound region (including the communities of Seward, Nanwalek, Port Graham, and Willow Creek, which are not included in the current energy planning region). The following regional energy characteristics are based on data for 1,271 homes (primarily in Valdez, Seward and Cordova):

- **Energy Use**: The average home in the Prince William Sound Region is 1,804 square feet and uses 128,000 BTUs of energy per square foot annually. This is 7% less than the statewide average.
- **Energy Cost**: The average yearly energy cost for homes in the region is $7,740—approximately 2.8 times more than the cost in Anchorage, and 3.6 times more than the national average. Average annual energy costs constitute approximately 12% of the median income for the area (Cold Climate Housing Research Center, 2014).

Residential Energy Efficiency Savings Completed. Common home energy efficiency and weatherization measures typically save Prince William Sound region households 32% to 33% on energy consumption, which translates into 500 to 600 gallons of fuel oil per home per year. Most of the energy savings is in home heating, although lighting efficiency upgrades also result in electrical savings.

The HER program requires homeowners to pay for an audit and recommended upgrades up front. The homeowner is then reimbursed up to a certain amount once work is done and a "post" audit is completed. HER reimbursable costs are limited to direct labor and materials. The average out of pocket expense to homeowners is around $4,800 statewide (Ord, 2015). This amount does not include the "rebate" or state funds that are invested into the upgrades. With annual cost savings averaging $1,464 statewide, the payback period for homeowners is 3.3 years (Lister, 2013).

In the Prince William Sound region, only residents in Cordova and Valdez have taken advantage of the HER program, which statewide, has been underutilized in rural communities. There are many reasons for the lack of participation in the program, such as inability to pay the up-front costs, lack of energy raters, cost of transportation for materials and lack of certified general contractors in rural communities.

To address one of the barriers to rural participation in the HER program, AHFC will now send a rater to a community if there are three to five customers signed up, depending on the size of the community (generally three for small communities or five for rural hub communities). Customers can always choose their own rater, but their costs will be lower if they use the AHFC-sponsored rater.

The Weatherization program provides similar services to the HER program. NPRHA is the service provider for the Prince William Sound region, the contractor for all the units in Chenega and Tatitlek, and the NPRHA developed units in Cordova and Valdez. AHFC administers the program, but the Alaska Community Development Corporation (ACDC) is the weatherization service provider in the region. The Weatherization program differs from HER in that it is free of charge and requires an application from which an applicant's eligibility is determined based on age, disability, dependents, and income level.

Nearly one in five homes (19%) in the region has completed either the Home Energy Rebate or Weatherization program since 2008 or has received BEES certification, as shown in Table 11 (BEES certification is given to new buildings that meet Alaska Building Energy Efficiency Standards).

Table 11: Estimate of Homes Participating in Energy Efficient Housing Programs in the Prince William Sound Region, 2008-2014

Occupied Homes	BEES-certified Homes[1]	Home Energy Rebates[2]	Weatherization[2]	Total EE Housing Stock	% EE Housing
2,567	144	237	96	477	19%

Sources: 1 (Wiltse, 2014), 2 (Ord, 2015). Other sources: U.S. Census.

Remaining Residential EE&C Savings Opportunities. Residential weatherization measures already completed account for over 26,000 MMBTU (one million British Thermal Units) annually in energy savings, nearly 200,000 gallons of heating fuel oil per year, and $815,564 in avoided fuel costs for the region (see Table 12). If the remaining energy inefficient housing stock is upgraded (or in some cases rebuilt), the savings from residential EE&C could save another 137,000 MMBTU per year. This would save another nearly one million gallons of heating oil and over $4.2 million annually in avoided fuel costs. This does not include savings from lighting or appliance upgrades or other measures that reduce electrical use (or the diesel used to generate electricity).

Table 12: Estimated Energy Savings and Potential Energy Savings from Residential EE&C in Prince William Sound Energy Planning Region

EE&C Savings Achieved				EE&C Savings Opportunity			
Occupied Housing Units (2010)	Annual Energy Savings (MMBTU)	Annual Diesel Savings (Gallons)	Annual Fuel Cost Savings ($ millions)	Remaining Residential EE&C Opportunity	Annual Energy Savings (MMBTU)	Annual Diesel Savings (Gallons)	Annual Fuel Cost Savings ($ millions)
2,567	26,085	187,288	$815,564	81%	137,419	986,670	$4.2 mil

Sources: (Ord, 2015) (Wiltse, 2014). Model Assumptions: All non-BEES-certified, income-eligible homes are weatherized. Remaining owner-occupied homes participate in Home Energy Rebate program. Assumes average energy savings for region based on 2008-14 ARIS data. Assumes retail heating fuel costs for communities as of August 2014.

- ## NON-RESIDENTIAL BUILDINGS AND PUBLIC FACILITIES

The potential savings from energy efficiency and conservation changes in non-residential buildings is also huge, though harder to quantify. By making both the behavioral changes (like setting back thermostats) and efficiency upgrades identified in energy audits, public and commercial building owners can typically save 20% on energy costs, as shown in Table 13. With over 5,000 publicly owned buildings in Alaska, AHFC estimates the potential statewide annual savings from public buildings alone would exceed $125,000,000 (Waterman, 2015).

Table 13: Savings Potential for Public and Commercial Facilities

Savings from Behavioral Changes Only	Behavioral Changes plus the Most Cost-Effective Retrofits	Savings from Implementing All Audit Recommendations
10-15% Savings	15-25% Savings	25-35% Savings

Source: (Waterman, 2014)

The lack of good data on non-residential building stock, including private commercial buildings and community facilities, makes it hard to estimate the savings potential in the Prince William Sound region, but it is significant. A small inventory project to collect information on the number, type and size of public and commercial buildings in each community could be used to identify and prioritize public and commercial EE&C opportunities and strategies. An initial list based on secondary data sources is presented in each community's energy profile.

Non-residential Buildings and Public Facilities Audits – Both AHFC and AEA have funded public facility and commercial energy audits in Alaska. In 2011 and 2012, AHFC funded 327 audits statewide, including two in the Prince William Sound energy planning region (both in Cordova). AEA's Commercial Building Energy Audit (CBEA) program funds audits for privately owned commercial buildings. Over half of the audits funded in 2013 were in non-railbelt communities (Alaska Energy Authority, 2014). Results from program participants indicate average energy savings of roughly one-third as a byproduct of economic efficiency investments, with average simple paybacks of just over six years. A total of three businesses in the planning region (two in Cordova, one in Valdez) have received energy audits through AEA's CBEA program.

Table 14: Non-residential Facility and Infrastructure Energy Efficiency Upgrades

AHFC Community Facility Audits	AEA Commercial Building Energy Audits
2	3

Source: (Alaska Energy Authority, 2013) (Alaska Energy Authority, 2014)

Since these programs only cover the cost of the audit (they do not reimburse owners for building improvements), it is not known how many of the recommended measures are completed by building owners. Statewide, AHFC estimates that few retrofits have been implemented to date (Waterman, 2014).

Non-Residential EE&C Programs. Since 2005, several state and federal programs have provided funding for EE&C improvements to non-residential buildings and public infrastructure in rural Alaska. Between 2005 and 2009, 49 communities statewide participated in the Village End Use Efficiency Measures (VEUEM) program, a Denali Commission initiative. Between 2010 and 2012, the American Recovery and Reinvestment Act (ARRA) funded public energy efficiency improvements in an additional 118 Alaska communities through the Small Cities Energy Efficiency Community Block Grant (EECBG) and Village Energy Efficiency Program (VEEP), open to communities with populations under 8,000. The last round of VEEP funding was for FY14. Future funding is not certain. Valdez and Cordova received EECBG awards to fund energy efficiency street light upgrades. To date, no communities in the Prince William Sound region have participated in VEEP.

Energy Efficient Lighting

Indoor Lighting Retrofits - Electrical efficiency measures such as lighting retrofits generally have shorter payback periods than other building efficiency measures, making them smart investments even without the incentive of grant funding. While communities in the Prince William Sound region may have already funded their own interior lighting upgrades, since no communities in the planning region have done so through the popular EECBG and VEEP programs, we assume there remains a significant opportunity in this area for energy efficiency investment and savings.

Street Lighting – Cordova and Valdez funded LED street lighting upgrades through their EECBG grants. The two communities are saving $24,000 to $48,000 per year. If not grant-funded, the Cordova project would have had a 4.1-year simple payback. Collectively, they are saving over 135,000 kWh in electricity (Alaska Energy Authority, 2013). In order to know if there is additional savings potential from street light upgrades in these communities as well as others in the region, information on the type and approximate number of street lights and other public outdoor lighting in each community is needed. The available information on street lighting from state data sources is included in each community's energy profile.

- WATER AND SEWER ENERGY EFFICIENCY

Sanitation systems are one of the single largest energy users in rural communities, accounting for 10% to 35% of a community's energy use. Alaska Native Tribal Health Consortium (ANTHC) estimates that for every $1 spent on energy retrofits of rural sanitation facilities (including the cost of audits), there will be a 50 cent return each year to communities plus a 50 cent annual return to the State's operating budget through lower PCE payments (Dixon et al., 2013).

According to ANTHC officials, the state does not currently have a good mechanism for funding energy efficiency projects in sanitation facilities. Many rural utilities have poor credit and lack the administrative capacity to acquire loans through the AHFC Energy Efficiency Revolving Loan Fund.

Communities that have completed retrofits have largely done so with nontraditional funding sources (Dixon et al., 2013).

- TRACKING ENERGY EFFICIENCY

Energy efficiency technology is advancing at a rapid pace, with the government teaming with universities, national laboratories and industry to advance research, development and commercialization of energy efficient and cost effective building technologies. One way to advance energy efficiency is through better tracking of energy use. Below are several means of tracking energy use.

Individual meter units. Single outlet kilowatt monitors connect to appliances and assess efficiency of energy consumption by the kilowatt-hour. These units can monitor electricity consumption and expenses by the day, week, month, or year. By gaining awareness of consumption, the user can implement energy-efficiency measures.

TED meters. "The Energy Detective" meter (TED) teaches energy efficiency and awareness through providing feedback on electrical energy usage. Studies have shown that an average of 20% can be saved on electric bills with the TED device. A "smart" energy meter placed within households allows each individual to monitor energy usage and predict monthly electric cost. The TED meter shows energy use in real time and also warns when the power cost equalization (PCE) limit has been reached (500 kWh), the point at which the cost dramatically increases. The average TED user saves five to 30% off their electricity bill when using these meters.

SmartGrid. "Smart grid" generally refers to a class of technology that uses computer-based remote control and automation to reduce electrical costs. These systems are made possible by two-way communication technology and computer processing that has been used for decades in other industries. Much in the way that a "smart" phone these days means a phone with a computer in it, smart grid means "computerizing" the electric utility grid. It includes adding two-way digital communication technology to devices associated with the grid (DOE). These smart grid upgrades add four features to the existing grid:

1. Upgrade power meters with smart meters, which have two-way communication capability – allowing the utility to retrieve data remotely, as well as disconnect or limit customers' electrical consumption for non-payment.
2. Install IHD (In Home Display) units that allow in-home displays of current electricity usage – kWh/day, kWh/week, kWh/month – bringing customer awareness of electric consumption.
3. Install smart distribution switches throughout the power grid to enable the utility to shut down small portions of the grid for repairs or upgrades instead of shutting down the entire grid.
4. Control usage by household and billing.

Benchmarking. Benchmarking serves as a valuable baseline tool to help owners understand if energy upgrades are effective. Baseline energy data for homes and public and commercial buildings are limited and not centrally available or analyzed. For individual homes, participation in the Home Energy Rebate or Weatherization program yields a significant amount of information on how energy is used and how energy use may be reduced. Energy audits by certified energy auditors contain detailed physical information about the structure and identify low- or no-cost efficiency projects that can be undertaken in the short term to jump-start conservation efforts.

- At the community or regional level, a public building inventory can be used to identify and prioritize public facility EE&C opportunities and develop an "EE&C Roadmap" for the community or region. Data can be collected using local labor and a standard input form. It should include, at a minimum, building type, age, square footage, fuel type, owner, occupancy, hours of operation and EE&C audit/renovation status. Additional data fields may include bulk fuel tank capacity and annual community fuel order by type, and the number and type of street lights or other public outdoor lighting. Data can be used to help ground truth statewide energy end use models and be used to develop a grant proposal for community or regional public facility EE&C upgrade projects.

- "Benchmarking" public and commercial buildings also benefits individual facility owners and managers by giving them the ability to see trends in a building's energy use and compare use and operating costs to other buildings. Owners can benchmark their facility by completing the REAL Benchmark Form at: http://www.ahfc.us/efficiency/research-information-center/energy-efficiency-public-facilities/.

Energy Efficiency Technology

There are ways that utilities can use technology to improve energy efficiency when appropriate to location and current energy systems in place. Some of those technologies are listed below:

***Microgrid*.** Microgrid power systems are small-scale power-generation solutions consisting of local power-generating facilities and individual homes and buildings equipped with wind and solar power systems. This type of distributed power generation is a lower-cost alternative to large-scale systems.

Microturbines. Microturbines generate both electric and thermal energy. Using both maximizes efficiency and minimizes a facility's energy bills. Using both energy outputs is called cogeneration or combined heat and power (CHP). Onsite CHP is far more fuel efficient and environmentally beneficial than utility power and traditional boiler methods. The system lowers a facility's demand on utility power and dramatically cuts monthly power bills.

In addition to burning liquid fuels such as diesel, kerosene, jet fuel, and liquid bio fuels, microturbines can burn almost any carbon-based gaseous fuel: natural gas, propane, methane and other waste gases to create renewable power and heat. Waste material buried in landfills biodegrades over time to produce methane, carbon dioxide, and other gases. Treatment of domestic wastewater, agricultural waste and food processing waste using anaerobic digestion also produces methane and other gases. Many sites flare these waste gases; or worse yet, vent them directly into the atmosphere. Methane has a greenhouse gas impact on the atmosphere that is 21 times that of carbon dioxide, and burning methane in a flare completely wastes its energy value (Capstone Microturbines). Microturbines provide a means to capture and reuse these waste products.

***Fuel Additives*.** Fuel additive products can help maximize vehicle fuel efficiency and help to avoid problems such as rough idling, weak acceleration, stumbling and stalling. Fuel additives have lower emissions and therefore reduce toxic pollutants including nitrogen oxide, improving air quality. Prudhoe Bay Service Area 10 (SA-10) has reduced vehicle fuel consumption by 10-15% efficiency by using fuel additives in their vehicles.

Heat Recovery. Even when electrical generators operate at maximum efficiency, 60% of all energy in the diesel fuel will be released as heat. The waste jacket heat can be run through a heat exchanger that transfers the heat to a heat loop that can warm the power plant itself or a nearby building. Typically this is a school, clinic, community hall, or the village water system. This process can recover 10 to 20% of the energy in the fuel. The heat can be measured and, if a heat sales contract is developed, sold to a user, providing another revenue source for the utility.

The heat expelled in the exhaust is more difficult to capture — cooling the exhaust causes sulfuric acid to develop and can cause other operational issues with the engine. Low sulfur diesel and other technologies may help limit these issues (YourCleanEnergy, November 2013).

While excess or waste heat is primarily a byproduct of diesel generation, heat can be harnessed from hydro plants or wind farms in situations where there is excess power (e.g. water going over the spillway) that can be used as a dump load to power an electric heater.

Two of the communities in the Prince William Sound energy planning region (Cordova and Chenega Bay) already have heat recovery systems. Additional opportunities may exist to increase the use of waste heat from power generation by installing new systems in diesel plants that lack them, or by expanding the number of facilities heated by existing systems if there is excess capacity.

Interties. One potential means of reducing the cost of energy production is to create economies of scale by connecting nearby communities in an electrical grid. Unfortunately, the cost of building and maintaining alternating current (AC) electrical interties is high, making the economics challenging for all but the closest communities. As a result, the majority of remote communities in Alaska must generate their own power, resulting in duplicate energy infrastructure and contributing to the high cost of power in rural areas.

In the Prince William Sound energy planning region, only Valdez and Whittier are connected to electrical grids serving more than one community. These communities also have the lowest non-PCE subsidized electrical rates in the region.

Table 15: Interties in the Prince William Sound Energy Planning Region

Communities connected by intertie	Utility
Valdez	Copper Valley Electric Association
Whittier	Chugach Electric Association

The Alaska Center for Energy and Power (ACEP) is engaged in a High Voltage Direct Current (HVDC) transmission project to “assess and demonstrate the technical and financial feasibility of low-cost small-scale HVDC interties for rural Alaska.” The objective is to determine whether small-scale HVDC interties are technically viable and can achieve significant cost savings compared to connecting Alaskan villages with three-phase AC interties. HVDC technology has the potential to significantly reduce the cost of remote Alaskan interties, reducing the costs to interconnect remote villages and/or develop local energy resources (ACEP, 2014).

B. REGIONAL ENERGY PRIORITIES

The following table contains regional energy priorities. The regional projects were identified through discussions with officials and stakeholders. They are broken down into the following time tables:

- Immediate projects which are currently underway or expected to begin in the next 12 months,
- Short range, expected to start within 1-5 years,
- Medium range projects expected to take place between 5-10 years, and
- Long range projects expected to occur beyond 10 years, which can be more speculative in nature.

Timeframe	Project Name
Energy Efficiency and Conservation	
Immediate 0-1 year	
Short 1-5 years	
Medium 5-10 years	
Maintenance and Operations	
Immediate 0-1 year	
Short 1-5 years	
Planning	
Short 1-5 years	
Medium 5-10 years	
Energy Financing	
Immediate 0-1 year	
Short 1-5 years	
Energy Infrastructure	

Short 1-5 years	.
Medium 5-10 years	
Long >10 years	

CHAPTER 4

Community Summaries

COMMUNITY SUMMARIES

This chapter provides an overview of each community, their energy use, and available energy resources and outlines local energy priorities.

COMMUNITY SUMMARIES

The following section contains a community and energy profile for each of the PWSEDD communities, along with a list of energy priorities that was developed through literature research and with input by PWSEDD staff, elected local and regional leaders, industry representatives, local leaders and the public.

The community profiles contain general information about the location, economy, historical and cultural resources, planning, demographics, contacts and infrastructure. In addition, the community profiles include information about AEA and Department of Energy's (DOE) Energy Efficiency Community Block Grants and Village Energy Efficiency Program (VEEP) program that funded energy efficiency improvements. Also included is information about the 2010 AHFC audits. These energy grade audits detail improvements that could be made to make buildings more energy efficient.

The energy profiles for each community provide an overview of energy production and distribution. It is intended to provide a snapshot of local energy conditions. Following the energy profiles for each community is a priority energy matrix with actions intended to reduce energy use and minimize energy costs to the utility and to the consumers.

Chenega Bay

Community and Energy Profile

Community Profile: Chenega Bay

Alaska Native Name (definition)

Chenega, "Under the Mountain"

Historical Setting / Cultural Resources

The name of this Alutiiq village was first reported by Ivan Petroff in the 1880 Census. At that time, the village was located on the southern tip of Chenega Island. A post office was established in 1946. Tsunamis destoyed the village was destroyed and killed over half of all residents in the sound after the 1964 Earthquake. The village was reestablished twenty years later on Evans Island, at the site of the former Crab Bay herring saltery. In the summer of 1984, 21 homes, an office building, community hall, school, 2 teacher's houses, a church, and community store were constructed.

Incorporation Unincorporated in the Valdez-Cordova Census Area

Location

Chenega Bay is located on Evans Island at Crab Bay, 42 miles southeast of Whittier in Prince William Sound. It is 104 air miles southeast of Anchorage and 50 miles east of Seward.

Longitude	-148.0104	Latitude	60.0657
ANCSA Region	Chugach Alaska Corporation		
Borough/CA	Valdez-Cordova		
School District	Chugach School District		
AEA Region	Copper River/Chugach		

Taxes Type (rate)	Per-Capita Revenue
N/A	N/A

Economy

Chenega Bay is an Alutiiq community practicing a subsistence and commercial fishing lifestyle.

Climate	Avg. Temp.	Climate Zone	Heating Deg. Days
	63/17	Maritime	N/A

Natural Hazard Plan

N/A

Community Plans	Year
Chenega Bay Master Plan	2008

Local Contacts	Email	Phone	Fax
The Chenega Corporation	http://www.chenega.com	907-277-5706	907-277-5700
Native Village of Chenega		907-573-5132	907-573-5120

Demographics	2000	2010		2013
Population	86	76	Percent of Residents Employed	87.80%
Median Age	31	31	Denali Commission Distressed Community	Yes
Avg. Household Size	4	3	Percent Alaska Native/American Indian (2010)	52.63%
Median Household Income	N/A	$47,813	Low and Moderate Income (LMI) Percent (201x)	N/A

Electric Utility	Generation Sources	Interties	PCE?
Chenega Bay Utilities	Diesel	No	Yes

Landfill	Class	Permitted?	Location
	III	No	West of Knight Island

Water/Wastewater System

		Homes Served	System Volume
Water	Groundwater Well	50	10,000-50,000
Sewer	Backhaul sludge to Valdez disposal site, piped	Water/Wastewater Energy Audit? No	
Notes			

Access

Road	No				
Air Access	Chenega Bay Airport, gravel, good condition	Runway 1	3,000'x75'	Runway 2	N/A
		Runway 3	N/A	Runway 4	N/A
Dock/Port	Yes	Barge Access?	No	Ferry Service?	Yes
Notes					

Energy Profile: Chenega Bay

Diesel Power System

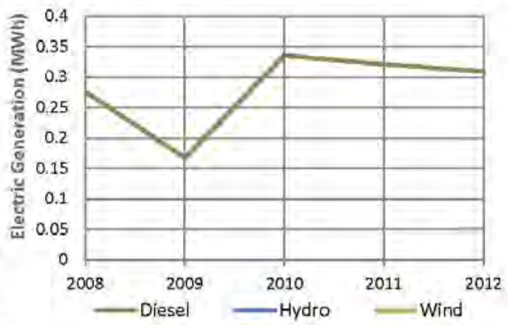
Utility	Chenega IRA Council		
Engine	Make/Model	Condition/Hrs	Gen Capacity
Unit 1	John Deere	Good; 10,758	45
Unit 2	John Deere	Good; 16,457	65
Unit 3	John Deere	Good; 18,453	65

Line Loss	7.4%		
Heat Recovery?	Yes (Storage Shed)		
Upgrades	Priority	Projects	Status
RPSU Powerhouse	Low		
RPSU Distribution	Med.		
Outage History/Known Issues			

Operators	No. of Operators	Training/Certifications
	8	APPO, PPO, BFO, BF Bus., Clerk
Maintenance Planning (RPSU)		Good

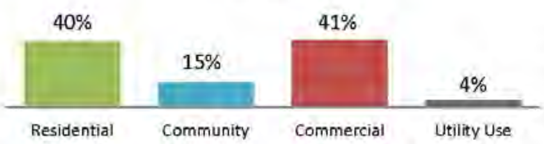
Annual Power Production

Diesel (kWh)	287,068	Avg. Load (kW)	28
Wind (kWh)	0	Peak Load (kW)	62
Hydro (kWh)	0	Diesel Efficiency	11.8
Total (kWh)	287,068	Diesel Used (gals)	24,312



Electric Sales	No. of Customers	kWh/year	kWh/Customer
Residential	25	106,673	4,267
Community	6	39,622	6,604
Commercial	14	108,948	7,782
Utility Use		10,669	

Electric Sales by Customer Type (kWh/year)



Electric Rates ($/kWh)		Cost per kWh Sold ($/kWh)	
Rate with PCE	$0.17	Fuel Cost	$0.50
Residential Rate	$0.67	Non-fuel Cost	$0.11
Commercial Rate		Total Cost	$0.61

Fuel Prices ($)	Utility/Wholesale	Retail	Month/Year
Fuel Oil (1 gal)	$5.44	$7.22	6-13; 8-14
Other Fuel? (1 gal)			
Gasoline (1 gal)			
Propane (100#)		$386.43	8-14
Wood (1 cord)			
Pellets			
Discounts?			

Alternative Energy	Potential	Projects (status)	Notes
Hydroelectric	Medium	Chenega Bay Hydro (design & permitting)	Applied for funding REF 8
Wind Diesel	Low		
Biomass	High		
Solar	Low		
Geothermal	Low		
Oil and Gas	Low		
Coal	Low		
Emerging Tech	Not Rated		
Heat Recovery	High	HR to storage shed (operational)	
Energy Efficiency	High		

Bulk Fuel

Tank Owner	Fuel Type(s)	Capacity	Age/Condition

Purchasing	Deliveries/Year	Gallons/Delivery	Vendor(s)
By Barge			
By Air			
Notes			

Bulk Fuel Upgrade Program

Completed

Energy Profile: Chenega Bay

Housing Units	Occupied	Vacant	% Owner-Occup.	Regional Housing Authority	Weatherization Service Provide
	29	13	72%	North Pacific Rim	North Pacific Rim

Housing Need		Overcrowded	1-star
		27.6%	N/A
Data Quality	Low		

Energy Use	Average Home Energy Rating	Average Square Feet	Avg. EUI (kBTU/sf)
	N/A	N/A	N/A

Age of Housing Stock

Energy Efficient Housing Stock

Street Lighting	Owner	Number/Type	Retrofitted?	Year	Notes

Non-residential Building Inventory

Building Name or Location	Year Built	Square Feet	Audited?	Retrofits Done?	In ARIS?
Chenega Bay Community School					No
Gas Station					No
Hazardous Waste Bldg					No
Info Center					No
John M. Totemoff Museum					No
Native Village of Chenega Office					No
Nicholas Kompkoff Clinic					No
Old Church					No
Rec Center					No
Russian Orthodox Church					No
School Generator, Fuel Tanks & Storage					No
Sea Lion Subsistence Processing Plant					No
SRE Bldg 1		1,104			No
SRE Bldg 2 (Heated)		2,000			Yes
Teacher Housing					No
Tribal Council Maint. Bldg					No
United Utilities Inc.					No
Village Generator & Fuel Storage					No

Cordova

Community and Energy Profile

Community Profile: Cordova

Incorporation	Home Rule City, 1909		

Location

Cordova is located at the southeastern end of Prince William Sound in the Gulf of Alaska. The community was built on Orca Inlet at the base of Eyak Mountain. It lies 52 air miles southeast of Valdez and 150 miles southeast of Anchorage.

Longitude	-145.7575	**Latitude**	60.5428
ANCSA Region	Chugach Alaska Corporation		
Borough/CA	Valdez-Cordova		
School District	Cordova City School District		
AEA Region	Copper River/Chugach		

Taxes Type (rate)	Per-Capita Revenue
Sales, 6%	$2,220

Alaska Native Name (definition)

Eyak, "Beach"

Historical Setting / Cultural Resources

The area has historically been home to the Alutiiq and migrating Athabascan and Tlingit Natives who called themselves Eyaks. Orca Inlet was originally named "Puerto Cordoba" in 1790. By 1887 two canneries were operating in the Odiak Slough area. By the 1920s, Cordova became known as the Razor Clam Capital of the World. One of the first producing oilfields in Alaska was discovered at Katalla, 47 miles southeast of Cordova, in 1902. The town of Cordova was named in 1906 by Michael Heney, builder of the Copper River and Northwestern Railroad. Cordova became the railroad terminus and ocean shipping port for copper ore from the Kennecott Mine up the Copper River. The Bonanza-Kennecott Mines operated until 1938 and yielded over $200 million in copper, silver, and gold. The Katalla oil field produced until 1933, when it was destroyed by fire.

Economy

Cordova has a significant Eyak Athabascan population with an active village council. Fishing became the economic base in the early 1940s. Commercial fishing and subsistence are central to the community's culture.

Climate	Avg. Temp.	Climate Zone	Heating Deg. Days
	63/17	Maritime	8,611

Natural Hazard Plan

Local Hazards Mitigation Plan

Community Plans	Year
City of Cordova 2008 Comprehensive Plan	2008

Local Contacts	Email	Phone	Fax
City of Cordova	cityclerk@cityofcordova.net	907-424-6200	907-424-6000
The Eyak Corporation		907-424-7161	907-424-5161
Native Village of Eyak	reyna@eyak-nsn.gov	907-424-7738	907-424-7739

Demographics	2000	2010
Population	2,454	2,239
Median Age	37	42
Avg. Household Size	3	3
Median Household Income	N/A	$96,875

	2013
Percent of Residents Employed	87.92%
Denali Commission Distressed Community	No
Percent Alaska Native/American Indian (2010)	8.84%
Low and Moderate Income (LMI) Percent (201x)	35.9%

Electric Utility	Generation Sources	Interties	PCE?
Cordova Electric Cooperative, Inc.	Hydropower, Diesel	No	Yes

Landfill	Class	Class II	Permitted?	Yes	Location	18 mi east of Cordova

Water/Wastewater System		Homes Served	System Volume
Water	Surface Water	2,700	5,000,001-10,000,000
Sewer	Pump/Piped	**Water/Wastewater Energy Audit?**	
Notes		No	

Access

Road	No				
Air Access	Municipal Airport, gravel, fair condition; water	Runway 1	1,800'x60'	Runway 2	8,000'x3,000'
	Merle K (Mudhole) Smith, asphalt, good; gravel	Runway 3	7,500'x150'	Runway 4	1,899'x30'
Dock/Port	Yes	Barge Access?	Yes	Ferry Service?	Yes
Notes					

Energy Profile: Cordova

Diesel Power System

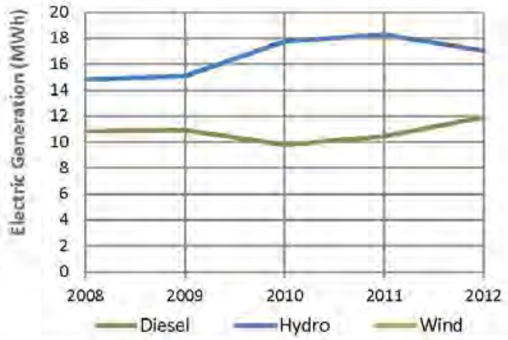
Utility	Cordova Electric Cooperative		
Engine	**Make/Model**	**Condition/Hrs**	**Gen Capacity**
Unit 1	EMD	Fair; 116,065	2,500
Unit 2	Fbks. Morse	Fair; 73,704	2,403
Unit 3	Caterpillar	Fair; 32,120	1,125
Unit 4	Caterpillar	Good; 36,209	1,125
Unit 5	EMD	Good; 5,188	3,700
Line Loss	7.1%		
Heat Recovery?	Yes; Organic Rankine Cycle		
Upgrades	**Priority**	**Projects**	**Status**
RPSU Powerhouse	High		
RPSU Distribution	Low		
Outage History/Known Issues			

Operators	**No. of Operators**	**Training/Certifications**
	1	Hydro
Maintenance Planning (RPSU)		Excellent

Electric Sales	**No. of Customers**	**kWh/year**	**kWh/Customer**
Residential	772	4,801,576	6,220
Community	59	2,626,612	44,519
Commercial	810	18,351,377	22,656
Utility Use		469,603	

Annual Power Production

Diesel (kWh)	10,797,853	**Avg. Load (kW)**	2,475
Wind (kWh)	0	**Peak Load (kW)**	5,501
Hydro (kWh)	17,453,931	**Diesel Efficiency**	13.1
Total (kWh)	28,251,784	**Diesel Used (gals)**	821,640



Electric Rates ($/kWh)		**Cost per kWh Sold ($/kWh)**	
Rate with PCE	$0.25	**Fuel Cost**	$0.12
Residential	$0.39	**Non-fuel Cost**	$0.18
Commercial		**Total Cost**	$0.30

Fuel Prices ($)	**Utility/Wholesale**	**Retail**	**Month/Year**
Fuel Oil (1 gal)	$3.66	$4.62	6-13; 8-14
Other Fuel? (1 gal)			
Gasoline (1 gal)		$5.03	3-13
Propane (100#)		$118.57	8-14
Wood (1 cord)			
Pellets			
Discounts?			

Alternative Energy	**Potential**	**Projects (status)**	**Notes**
Hydroelectric	High	Humpback Creek (operational), Crater Lake Feasibility/Design (recommended for funding)	
Wind Diesel	Medium		
Biomass	Medium	Community Biomass (feasibility), Wood Processing Plant (completed)	
Solar	Low		
Geothermal	Low		
Oil and Gas	Low		
Coal	Low		
Emerging Tech	Not Rated		
Heat Recovery	High	ORC Heat Recovery (operational)	City water tank potential load
Energy Efficiency	High		

Bulk Fuel

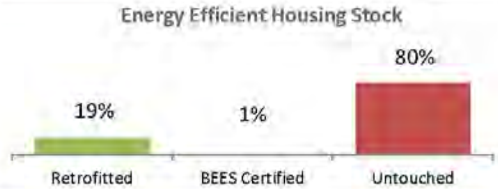
Tank Owner	**Fuel Type(s)**	**Capacity**	**Age/Condition**
Bulk Fuel Upgrade	**Priority**	**Project**	**Status**

Purchasing	**Deliveries/Year**	**Gallons/Delivery**	**Vendor(s)**
By Barge			
By Air			
Notes			

Energy Profile: Cordova

Housing Units	Occupied	Vacant	% Owner-Occup.
	832	281	78%
Housing Need		Overcrowded	1-star
		3.6%	10.4%
Data Quality	High		

Regional Housing Authority	Weatherization Service Provider		
North Pacific Rim	North Pacific Rim		
Energy Use	Average Home Energy Rating	Average Square Feet	Avg. EUI (kBTU/sf)
	2 star plus	1,866	125



Street Lighting	Owner	Number/Type	Retrofitted?	Year	Notes
EECBG Retrofit		113	Yes		$24,000 annual savings

Non-residential Building Inventory

Building Name or Location	Year Built	Square Feet	Audited?	Retrofits Done?	In ARIS?
Airport Sand Storage		8,750			Yes
ARFF Bldg.		5,456			Yes
Community Medical Center	1986	53,700	Yes (AHFC-C)	Not Known	Yes
Cordova Bunkhouse		2,876			Yes
Cordova Headquarters		3,920			Yes
Cordova Jr/Sr High School	1966	54,221	Yes (AHFC-C)	Not Known	Yes
Cordova Labor Hall		6,232			Yes
Cordova Warehouse					Yes
Eyak Lake A/P SRE Bldg.		2,400			Yes
Maintenance Shop		5,536			Yes
Mt. Eccles Elementary		46,009			Yes
Shoreside/Alaska Marine Lines Bldg			Yes (ACEA)	Not Known	No
SREB Bldg.		2,852			Yes

Tatitlek

Community and Energy Profile

Community Profile: Tatitlek

Alaska Native Name (definition)
Tatitlek, "Windy Place"

Historical Setting / Cultural Resources
It is an Alutiiq village first reported in the 1880 U.S. Census as "Tatikhlek," with a population of 73. The present spelling was published in 1910 by the U.S. Geological Survey, which wrote that the village originally stood at the head of Gladhaugh Bay but was moved to its present site in the shadow of Copper Mountain around 1900. A post office was established in 1946. Many residents of Chenega moved to Tatitlek following its destruction by tsunami after the 1964 Good Friday Earthquake. The dominant feature in the village is the blue-domed Russian Orthodox church.

Incorporation	Unincorporated in the Valdez-Cordova Census Area

Location
Tatitlek is located on the northeast shore of Tatitlek Narrows, on the Alaska Mainland in Prince William Sound. It lies near Bligh Island, southwest of Valdez by sea and 30 air miles northwest of Cordova.

Longitude	-146.6786	**Latitude**	60.8647
ANCSA Region	Chugach Alaska Corporation		
Borough/CA	Valdez-Cordova		
School District	Chugach School District		
AEA Region	Copper River/Chugach		

Taxes Type (rate)	Per-Capita Revenue
N/A	N/A

Economy
Tatitlek is a coastal Alutiiq village with a fishing and subsistence based culture.

Climate	Avg. Temp.	Climate Zone	Heating Deg. Days
	63/17	Maritime	8,484

Natural Hazard Plan
N/A

Community Plans	Year
Native Village of Tatitlek Strategic Plan	2001

Local Contacts	Email	Phone	Fax
The Tatitlek Corporation		907-278-4000	907-278-4050
Native Village of Tatitlek	totemoffdavid@yahoo.com	907-325-2311	907-325-2298

Demographics	2000	2010		2013
Population	107	88	**Percent of Residents Employed**	95.16%
Median Age	31	35	**Denali Commission Distressed Community**	No
Avg. Household Size	3	3	**Percent Alaska Native/American Indian (2010)**	60.23%
Median Household Income	N/A	$35,417	**Low and Moderate Income (LMI) Percent (201x)**	N/A

Electric Utility	Generation Sources	Interties	PCE?
Tatitlek Electric Utility	Diesel	No	Yes

Landfill	Class	III	Permitted?	No	Location	East side of Prince William Sound

Water/Wastewater System		Homes Served	System Volume
Water	Piped	95	170,000
Sewer	Piped	**Water/Wastewater Energy Audit?**	
Notes		No	

Access

Road	No				
Air Access	Tatitlek Airport, gravel, fair condition; water	**Runway 1**	3,701'x75'	**Runway 2**	8,000'x4,000'
	N/A	**Runway 3**	N/A	**Runway 4**	N/A
Dock/Port	Yes	**Barge Access?**	No	**Ferry Service?**	Yes
Notes					

Energy Profile: Tatitlek

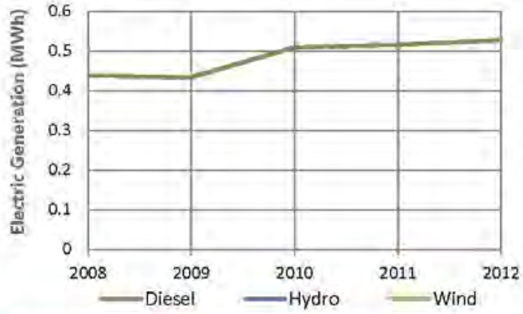
Diesel Power System

Utility	Tatitlek Village IRA Council		
Engine	**Make/Model**	**Condition/Hrs**	**Gen Capacity**
Unit 1	John Deere	Poor; 75,790	100
Unit 2	John Deere	Poor; 35,503	125
Unit 3	John Deere	Good; 4,435	90
Unit 4			
Line Loss	8.0%		
Heat Recovery?	No		
Upgrades	**Status**		**Notes**
RPSU Powerhouse	CDR (In progress)		Partial funding
RPSU Distribution	CDR (In progress)		Partial funding
Outage History/Known Issues			

Operators	**No. of Operators**	**Training/Certifications**
	2	APPO, PPO, Clerk, BFO
Maintenance Planning (RPSU)		Good

Annual Power Production

Diesel (kWh)	507,700	**Avg. Load (kW)**	45
Wind (kWh)	0	**Peak Load (kW)**	101
Hydro (kWh)	0	**Diesel Efficiency**	12.1
Total (kWh)	507,700	**Diesel Used (gals)**	42,068



Electric Sales	**No. of Customers**	**kWh/year**	**kWh/Customer**
Residential	53	130,826	2,468
Community	5	77,347	15,469
Commercial	20	207,794	10,390
Utility Use		51,332	

Electric Rates ($/kWh)		**Cost per kWh Sold ($/kWh)**	
Rate with PCE	$0.34	Fuel Cost	$0.54
Residential	$0.87	Non-fuel Cost	$0.16
Commercial		Total Cost	$0.70

Fuel Prices ($)	**Utility/Wholesale**	**Retail**	**Month/Year**
Diesel (1 gal)	$5.43		6-13
Other Fuel? (1 gal)			
Gasoline (1 gal)			
Propane (100#)			
Wood (1 cord)			
Pellets			
Discounts?			

Alternative Energy	**Potential**	**Projects (status)**	**Notes**
Hydroelectric	Not Rated		
Wind Diesel	Low	Tatitlek Wind/hydro (feasibility completed)	Low wind class found
Biomass	High		
Solar	Low		
Geothermal	Low		
Oil and Gas	Low		
Coal	Low		
Emerging Tech	Not Rated		
Heat Recovery	Low*	Heat Recovery Project (to be completed 1/2015)	*after project completed
Energy Efficiency	High		

Bulk Fuel

Tank Owner	**Fuel Type(s)**	**Capacity**	**Age/Condition**

Purchasing	**Deliveries/Year**	**Gallons/Delivery**	**Vendor(s)**
By Barge			
By Air			
Cooperative Purchasing Agreements			

Bulk Fuel Upgrade Program	**Status**
Phase III Concept Design Report (CDR)	In progress

Energy Profile: Tatitlek

Housing Units	Occupied	Vacant	% Owner-Occup.	Regional Housing Authority	Weatherization Service Provider
	27	43	63%	North Pacific Rim	North Pacific Rim

Housing Need	Overcrowded	1-star
	N/A	N/A

Energy Use	Average Home Energy Rating	Average Square Feet	Avg. EUI (kBTU/sf)
	N/A	N/A	N/A

Data Quality	Med.

Street Lighting	Owner	Number/Type	Retrofitted?	Year	Notes

Non-residential Building Inventory

Building Name or Location	Year Built	Square Feet	Audited?	Retrofits Done?	In ARIS?
Airport					No
Airport Electrical		80			No
Assisted Living/Laundromat					No
Community School					No
Community School Voc. Lab					No
Copper Valley Telephone					No
Fire Hall					No
Generator Facility					No
Mariculture Processing Facility					No
Native Village of Tatitlek Office					No
Oil Spill Response Storage					No
Orthodox Church					No
SREB		3,250			No
Tatitlek Native Corp.					No
Village Community Center					No
Village Gospel Chapel					No
Water Treatment Plant					No

Valdez

Community and Energy Profile

Community Profile: Valdez

Incorporation	Home Rule City, 1901

Location

Valdez is located on the north shore of Port Valdez, a deep water fjord in Prince William Sound. It lies 305 road miles east of Anchorage and 364 road miles south of Fairbanks. It is the southern terminus of the Trans-Alaska oil pipeline.

Longitude	-146.3483	**Latitude**	61.1308
ANCSA Region	Chugach Alaska Corporation		
Borough/CA	Valdez-Cordova		
School District	Chugach School District		
AEA Region	Copper River/Chugach		

Alaska Native Name (definition)

N/A

Historical Setting / Cultural Resources

The Port of Valdez was named in 1790 after Spanish naval officer Antonio Valdes y Basan. A town developed in 1898 as a debarkation point for men seeking a route to the Eagle Mining District and the Klondike gold fields. A road for car travel to Fairbanks was completed by the 1920s. A slide of unstable submerged land during the 1964 earthquake destroyed the original city waterfront. The community was rebuilt on a more stable bedrock foundation 4 miles to the west. During the 1970s, construction of the Trans-Alaska Oil Pipeline terminal and other cargo transportation facilities brought rapid growth to Valdez. In March 1989 it was the center for the massive oil-spill cleanup after the "Exxon Valdez" disaster. In a few short days, the population of the town tripled.

Taxes Type (rate)	Per-Capita Revenue
Sales, 0%	$9,500

Economy

As a result of significant oil taxation revenues, the city offers a variety of quality public services.

Climate	Avg. Temp.	Climate Zone	Heating Deg. Days
	67/17	Maritime	8,611

Natural Hazard Plan	
Local Hazards Mitigation Plan	2007

Community Plans	Year
Valdez Comprehensive Plan	2007

Local Contacts	Email	Phone	Fax
City of Valdez	spierce@ci.valdez.ak.us	907-835-4313	907-835-2992
The Valdez Native Tribe		907-835-4951	907-835-5589

Demographics	2000	2010		2013
Population	4,036	3,976	Percent of Residents Employed	91.68%
Median Age	36	35	Denali Commission Distressed Community	No
Avg. Household Size	3	3	Percent Alaska Native/American Indian (2010)	8.17%
Median Household Income	N/A	$93,625	Low and Moderate Income (LMI) Percent (201x)	N/A

Electric Utility	Generation Sources	Interties	PCE?
Copper Valley Electric Association, Inc.	Hydropower, Diesel	No	No

Landfill	Class	II	Permitted?	Yes	Location	Mile 0.6 on the Valdez Glacier Road

Water/Wastewater System		Homes Served	System Volume
Water	Pressure	1,346	1,500,000
		Water/Wastewater Energy Audit?	
Sewer	Gravity	Yes	

Access					
Road	Yes				
Air Access	Pioneer Field, asphalt, good condition; Hospital Heliport	Runway 1	6,500'x150'	Runway 2	40'x40'
	Robe Lake Seaplane Base, water, good condition	Runway 3	4,000x200'	Runway 4	2,000x200'
Dock/Port	Yes	Barge Access?	Yes	Ferry Service?	Yes
Notes					

Energy Profile: Valdez

Diesel Power System		PCE
Utility	Copper Valley Electric	Ineligible
System Capacity	8.9 MW (Total)	
Heat Recovery?	No	

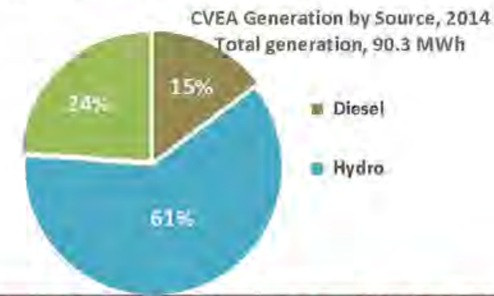
Upgrade Plans

Plans to replace two old diesel generator units with refurbished units to improve efficiency and add capacity. Engineering and permitting schedule for 2015. Replacemnt in 2016.

Outage History/Known Issues

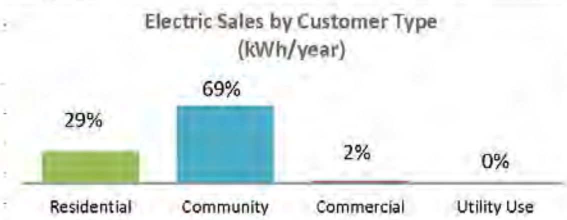
Avalanche risk in Thompson Pass

Annual Power Production (2014)		
Diesel (kWh)	13,248,531	Diesel Efficiency (kWh/gal)
Cogen (kWh)	21,510,330	13.8 (Valdez plant)
Hydro (kWh)	55,503,800	Diesel Used (gals/year)
Total (kWh)	90,262,661	235,471 (Valdez plant)



Electric Rates ($/kWh) - 2014		Cost per kWh Sold ($/kWh)	
Rate with PCE	N/A	Fuel Cost	N/A
Summer	$0.18	Non-fuel Cost	N/A
Winter	$0.24 - $0.28	Total Cost	N/A

Electric Sales	No. of Customers	kWh/year	kWh/Customer
Residential	1,631	10,470,371	6,420
Community	41	839,476	66,780
Commercial	377	25,176,019	20,475
Utility Use	N/A		



Fuel Prices ($)	Utility/Wholesale	Retail	Month/Year
#1 Heating (1 gal)		$4.13	8-14
Other Fuel? (1 gal)			
Gasoline (1 gal)		$4.47	3-13
Propane (100#)		$107.14	8-14
Wood (1 cord)			
Pellets			
Discounts?			

Alternative Energy	Potential	Projects (status)	Notes
Hydroelectric	High	Solomon Gulch (operational), Allison Creek (under construction)	
Wind Diesel	Medium*		*Turbulence in Thompson Pa
Biomass	Medium		
Solar	Low		
Geothermal	Low		
Oil and Gas	Low*		*for exploration/developmer
Coal	Low		
Emerging Tech	Not Rated		
Heat Recovery	Low		
Energy Efficiency	High		

Bulk Fuel

Tank Owner	Fuel Type(s)	Capacity	Age/Condition

Purchasing	Deliveries/Year	Gallons/Delivery	Vendor(s)
By Barge			
By Air			

Cooperative Purchasing Agreements

Notes

Bulk Fuel Upgrade	Priority	Project	Status

Energy Profile: Valdez

Housing Units	Occupied	Vacant	% Owner-Occup.	Regional Housing Authority	Weatherization Service Provider
	1565	196	80%	North Pacific Rim	North Pacific Rim

Housing Need		Overcrowded	1-star
		4.5%	6.5%

Energy Use	Average Home Energy Rating	Average Square Feet	Avg. EUI (kBTU/sf)
	2 star plus	1,975	135

Data Quality	High

Age of Housing Stock

Energy Efficient Housing Stock

Street Lighting	Owner	Number/Type	Retrofitted?	Year	Notes
EECBG Upgrade			Yes	2012	Replaced High Pressure Sodium with betaLEDs

Commercial Building Energy Audit (CBEA)

Audit submitted for 1 commercial building in Valdez

Non-residential Building Inventory

Building Name or Location	Year Built	Square Feet	Audited?	Retrofits Done?	In ARIS?
Airport Equipment Shop		3,200			Yes
Airport Sand Storage		1,744			Yes
ARFF Bldg.		6,320			Yes
Buildings Crew Shop		4,100			Yes
Combined Facilities					Yes
DOT&PF Headqaurters Bldg.		10,188			Yes
Epiphany Lutheran Church		4,000			No
Growden-Harrison Bldg.		30,295			Yes
Maintenance Shop (Hwy. Crew)		8,080			Yes
Rogue's Garden Bldg.		8,800			Yes
Sand Storage		3,920			Yes
SEF Maintenance Shop		8,920			Yes
Steam Plant					Yes
Supply Bldg.		3,200			Yes
Valdez Diesel Plant	1964				No

Whittier

Community and Energy Profile

Community Profile: Whittier

Incorporation	2nd Class City, 1969		
Location	Whittier is on the northeast shore of the Kenai Peninsula, at the head of Passage Canal. It is on the west side of Prince William Sound, 60 miles southeast of Anchorage.		
Longitude	-148.6839	**Latitude**	60.7731
ANCSA Region	Chugach Alaska Corporation		
Borough/CA	Valdez-Cordova		
School District	Chugach School District		
AEA Region	Copper River/Chugach		

Alaska Native Name (definition)

N/A

Historical Setting / Cultural Resources

Passage Canal was once the quickest route from Prince William Sound to Cook Inlet. Chugach Indians would portage to Turnagain Arm in search of fish. The town's name was first published in 1915 by the U.S. Coast & Geodetic Survey. A port and a railroad terminus were constructed by the U.S. Army for transporting fuel and other supplies into Alaska during World War II. The railroad spur and two tunnels were completed in 1943, and the Whittier Port became the entrance for troops and dependents of the Alaska Command. The huge buildings that dominate Whittier began construction in 1948. It was called the "city under one roof," with a hospital, bowling alley, theater, gym, swimming pool, and shops for Army personnel. The port remained an active army facility until 1960. Begich Towers now houses the majority of residents. The city was incorporated in 1969.

Taxes Type (rate)	Per-Capita Revenue
Seasonal Sales, 5%	$6,080

Economy

Residents engage in sport-fishing, commercial fishing, and subsistence activities.

Climate	Avg. Temp.	Climate Zone	Heating Deg. Days
	63/17	Maritime	8,664

Natural Hazard Plan	
Local Hazards Mitigation Plan	2007

Community Plans	Year
Whittier Comprehensive Plan Update	2007

Local Contacts	Email	Phone	Fax
City of Whittier	info@whittieralaska.gov	907-472-2327	907-472-2404

Demographics	2000	2010		2013
Population	182	220	Percent of Residents Employed	81.46%
Median Age	40	48	Denali Commission Distressed Community	No
Avg. Household Size	3	2	Percent Alaska Native/American Indian (2010)	5.45%
Median Household Income	N/A	$42,500	Low and Moderate Income (LMI) Percent (201x)	44%

Electric Utility	Generation Sources	Interties	PCE?
Chugach Electric Association	Natural Gas, Hydroelectric, Wind	Turnagain Arm Communities, Anchor	No

Landfill	Class	Permitted?	Location
	Class I	Yes	South of Eagle River

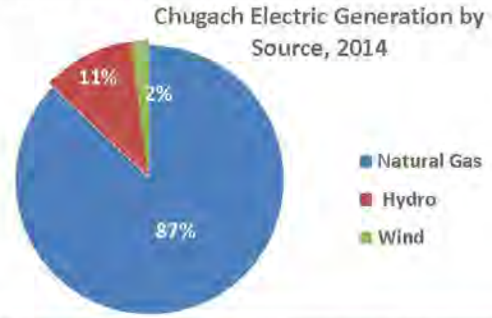
Water/Wastewater System		Homes Served	System Volume
Water	Groundwater Well	3,580	3 Wells 70'x80'; 530 gallons/min
Sewer		Water/Wastewater Energy Audit?	
Notes			

Access					
Road	No				
Air Access	Whittier Airport, gravel, fair condition	Runway 1	1,480'x60'	Runway 2	N/A
		Runway 3	N/A	Runway 4	N/A
Dock/Port	Yes	Barge Access?	Yes	Ferry Service?	Yes
Notes					

Energy Profile: Whittier

Diesel Power System		PCE
Utility	Chugach Electric	Ineligible
System Capacity	602.7	
Heat Recovery?		
Upgrade Plans		

Annual Power Production			
Nat. Gas (kWh)	2,449,640,393	Diesel Efficiency (kWh/gal)	
Wind (kWh)	56,313,572		
Hydro (kWh)	309,724,647	Diesel Used (gals/year)	
Total (kWh)	2,815,678,613		



Outage History/Known Issues

Electric Sales Issues

Begich Towers is classified as a Large Commercial user by the utility. For this reason, the residential electric sales displayed here do not reflect the total residential usage in Whittier.

Electric Sales	No. of Customers	kWh/year	kWh/Customer
Residential	2	10,965	5,483
Small Commercial	60	692,427	11,540
Large Commercial	26	6,371,374	245,053
Utility Use	N/A		

Electric Rates ($/kWh)		Cost per kWh Sold ($/kWh)	
Rate with PCE	NA	Fuel Cost	
Residential	$0.14	Non-fuel Cost	
Commercial		Total Cost	

Fuel Prices ($)	Utility/Wholesale	Retail	Month/Year
Fuel Oil (1 gal)		$4.05	8-14
Other Fuel? (1 gal)			
Gasoline (1 gal)			
Propane (100#)		$112.62	8-14
Wood (1 cord)			
Pellets			
Discounts?			

Alternative Energy	Potential	Projects (status)	Notes
Hydroelectric	Medium		
Wind Diesel	Medium		
Biomass	Low		
Solar	Low		
Geothermal	Low		
Oil and Gas	Low		
Coal	Low		
Emerging Tech	Not Rated		
Heat Recovery	Low		
Energy Efficiency	High		

Bulk Fuel			
Tank Owner	Fuel Type(s)	Capacity	Age/Condition

Bulk Fuel Upgrade	Priority	Project	Status

Purchasing	Deliveries/Year	Gallons/Delivery	Vendor(s)
By Barge			
By Air			

Cooperative Purchasing Agreements

Notes

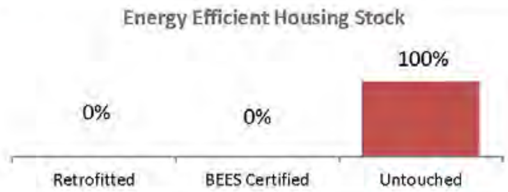
Energy Profile: Whittier

Housing Units	Occupied	Vacant	% Owner-Occup.	Regional Housing Authority	Weatherization Service Provid
	140	154	37%	North Pacific Rim	North Pacific Rim

Housing Need		Overcrowded	1-star
		6.4%	N/A

Energy Use	Average Home Energy Rating	Average Square Feet	Avg. EUI (kBTU/sf)
	N/A	N/A	N/A

Data Quality	Low



Street Lighting	Owner	Number/Type	Retrofitted?	Year	Notes

Non-residential Building Inventory

Building Name or Location	Year Built	Square Feet	Audited?	Retrofits Done?	In ARIS?

COMMUNITY OUTREACH

This chapter provides community comments collected at outreach meetings held throughout the Prince William Sound planning communities.

5 COMMUNITY OUTREACH

5.1 COMMUNITY COMMENTS

Community meetings were held in five communities in the Prince William Sound district to engage local leadership and community members in the planning process. This allowed for guidance in the grassroots approach to the energy planning process. The chart below shows the dates of the Community Outreach meetings, as well as engaged agencies and entities which participated in this process. Residents and other stakeholders were given opportunity to voice their opinions both orally in the meetings and in writing via comment forms. Comments spanned a broad range of topics related to energy and planners used the feedback to be sure that each area of concern was addressed in the plan.

Table 16: Community Meetings and Participants

COMMUNITY	COMMUNITY OUTREACH MEETING	ORGANIZATIONS ATTENDED	COMMUNITY ISSUES
Tatitlek	7/28/2015	WHPacific, PWSEDD, AEA, Tatitlek IRA, Tatitlek Corporation	Lack of water and sewer EE audits Would like a wind assessment in a new location Ocean Renewable Power is studying tidal energy CVEA did hydro study and too expensive due to location Would like school audit and EE upgrades Would like to explore alternative energy options (solar and biomass) EE on all buildings – residential and commercial
Whittier	7/29/2015	WHPacific, PWSEDD, AEA, City of Whittier	Seasonal community needs to be reflected in plan Needs EE water and sewer audits and improvements Would like to see if wind is an option Heat pump study (sea source) EE grants should allow funding in design phase (pre-construction vs. post) Would like to be an L & G feed line to Seward Peninsula
Chenega Bay	7/30/2015	WHPacific, AEA, PWSEDD, DOE, Chenega residents	EE on all buildings Would like to capture more heat recovery Biomass feasibility study Solar potential Would like to explore more alternatives as they become available

Valdez	8/04/2015	WHPacific, AEA, PWSEDD, City of Valdez, KCHU radio	Feasibility and alternative energy options CVEA has data on current energy usage EE and audits on all buildings
Cordova	8/05/2015	WHPacific, AEA, PWSEDD, City of Cordova, Native Village of Eyak, Cordova Electric Association Co-op (CEA)	Alternative energy source to heat pool More solar studies and application (one home) How do we capture seasonal booms in fishery to use for EE? Water supply boom/bust – needs EE Citywide EE assessment (Eyak) Integrate as many renewables as possible – funding source database

CHAPTER 6

Implementation Plan

IMPLEMENTATION PLAN

This chapter provides funding information and a strategy for completing the energy priorities.

6 IMPLEMENTATION PLAN

6.1 REGIONAL PRIORITY PROJECT

Regional priority energy actions were identified from the PWSEDD Community Economic Development project list, stakeholder interviews, input from the Energy Steering Committee and public meetings. The priorities were categorized into immediate (<1 year), short term (1-5 years), medium term (5-10 years) and long term (over 10 years). Potential sources, opportunities, and constraints for energy project funding projects are presented in Appendix A.

The overarching energy vision for the Prince William Sound Regional Energy Plan will serve as a clear guide for future energy actions. It is intended to be an inspiration and provide the framework for strategic planning. In our vision we can provide affordable energy, keep our people warm, and be the leaders in bringing the most economical, sustainable energy to rural Alaskan communities.

Each of the projects addresses issues or takes advantage of opportunities to improve the energy system and reduce energy costs. The projects have gone through initial screening, recognizing that grant funding is becoming scarcer and there is a need to be creative and realistic about what can be accomplished in the 20-year planning horizon. It is important that analysis of existing wind, heat recovery, solar and other energy saving measures be done to provide lessons learned for future projects.

The following table lists planned projects and includes a brief description or title of the project, if the project is ongoing or one recently identified by the energy steering committee or others, what the next step is in developing the project and the status of the funding. Columns have been left open for future planning efforts toward implementation of the energy projects.

PROJECTS	PROJECTS STATUS	NEXT STEPS	PARTNERS	FUNDING STATUS	Estimated Costs	Community
Energy Efficiency and Education						
Audit public purpose buildings and implement recommendations	Immediate 0-1 year	Inventory audits	AEA		TBD	All
Educate public in EE and conservation	Immediate 0-1 year	Conduct energy fairs Conduct energy classes Implement RurAL CAP Energywise type programs in each village Integrate AKSmart Energy curriculum in schools	School Districts		TBD	All
Require bidders on all new facilities to research and present at least one demonstration energy conservation feature, system or material application	Immediate 0-1 year Short 1-5 years	Set EE and appropriate design standards for Prince William Sound region Direct policy changes	AEA, DCCED, AVCP, RHA		TBD	All
Create a clearinghouse for data	Immediate 0-1 year	Locate site to house data			TBD	All
Work towards policy changes at the state and federal level on programs for maximum benefit	Immediate 0-1 year	Identify programs that could be modified for rural Alaska	AHFC, AEA, DOE, DCCED		TBD	All
Install metering systems, such as TED and smart meter grids, to track and collect energy production, consumption and cost	Short 1-5 years	Seek funding to implement metering systems	DOE, AEA, AHFC, USDA-RD, HUD, RHA		TBD	All
Conduct study to determine actual heating costs	Short 1-5 years	Collect data when available to start database for heating costs	AEA, DOE, RHA, RurAL CAP		TBD	All
Energy Infrastructure						

PROJECTS	PROJECTS STATUS	NEXT STEPS	PARTNERS	FUNDING STATUS	Estimated Costs	Community
Reassess current failing systems – such as water and sewer - and redesign for environment and energy efficiency as needed	Short 1-5 years	Conduct regional assessment of current infrastructure	ANTHC, AVCP, Tribal organizations		TBD	All
Electrical assessments and metering (regional level)	Short 1-5 years	Conduct electrical assessments; implement metering	DOE, AEA, USDA-RUC		TBD	All
Upgrade street lights	Medium 5-10 years	Identify communities who need upgrades; implement upgrades	AEA, Utilities, AVEC, USDA-RUC		TBD	All
Upgrade power plants for integration of renewable systems	Medium 5-10 years	Identify power plants that need upgrades; implement upgrades	AEA, Utilities, AVEC, USDA- RUC		TBD	All
Upgrade village power distribution systems	Medium 5-10 years	Identify power distribution lines that need upgrades; implement upgrades	AEA, Utilities, USDA-RUC		TBD	All
Planning						
Adopt an energy element into the local and regional comprehensive plans.	Short 1-5 years	Collaborate with local and regional entities to implement			TBD	All
Maintain Prince William Sound Regional strategic advisory group to monitor energy issues	Short 1-5 years	Seek funding to keep SAG going			TBD	All
Incorporate energy into local, regional, state and federal planning and CED processes	Short 1-5 years	Create database for regional information of funding			TBD	All
Coordinate with Land Management agencies early in the process and seek solutions that are acceptable to all	Short 1-5 years	Monitor land management for future projects	DNR, BLM, F&G			

PROJECTS	PROJECTS STATUS	NEXT STEPS	PARTNERS	FUNDING STATUS	Estimated Costs	Community
Energy Financing						
Develop strategy to educate legislators about region and energy challenges	Immediate 0-1 year	Invite legislators to region to see firsthand current conditions			TBD	All
Provide incentive matrix for bill payment through education and energy efficiency measures that reduce monthly bills	Short 1-5 years	Develop an incentive matrix that can be used throughout the region			TBD	All
Maintenance						
Train employees for new systems, including water and sewer, housing and power generation	Immediate 0-1 year	Assist in creating curriculum to help educate employees			TBD	All
Demolish and clean up fuel tank farms no longer in use	Short 1-5 years	Create database identifying tank farms that need demolishing			TBD	All
Install meters to monitor and manage fuel tanks more efficiently	Short 1-5 years				TBD	All

AkWarm: AHFC released AkWarm in 1996 as a software tool for builders, designers, energy raters, lenders, and homeowners. The software can be used for energy design, retrofit, or to determine an energy rating.

Alaska Energy Authority (AEA): A public corporation of the state with a separate and independent legal existence with the mission to construct, finance, and operate power projects and facilities that utilize Alaska's natural resources to produce electricity and heat. Website: http://www.akenergyauthority.org/

Alaska Retrofit Information System (ARIS): ARIS is a project funded by the Alaska Housing Finance Corporation (AHFC). The project goal is to create a means by which to collect, manage, access, and report on information relating to AHFC's rebate and weatherization programs, as well as other official uses of AkWarm.

Alaska Rural Utility Collaborative (ARUC): ARUC is a program managed by the Alaska Native Tribal Health Consortium. ARUC manages water and sewer systems in partnership with rural Alaska communities. ARUC management is intended to result in more cost-effective operations and maintenance.

ARUC sets rates with community council input. Each community's rates are set to be self-supporting, so rates will vary per community. ARUC hires a local water plant operator (and backup) in each community at good wages and retirement benefits. They purchase all fuel, parts, electricity, etc. for water/sewer system with money collected from water/sewer customer and often can find grant money to purchase fuel, supplies, and needed parts and repairs for ARUC communities in the first year of membership.

Auxiliary Generator: A generator at the electric plant site that provides power for the operation of the electrical generating equipment itself, including related demands such as plant lighting, during periods when the electric plant is not operating and power is unavailable from the grid. A black start generator used to start main central station generators is considered to be an auxiliary generator.

Backup (Standby) Generator: A generator that is used only for test purposes, or in the event of an emergency, such as a shortage of power needed to meet customer load requirements.

Barrel (bbl.): A unit of volume equal to 42 U.S. gallons.

Benchmarking: Benchmarking is the preliminary data collection and analysis that takes place before the audit. Typical benchmark data consists of building age, square footage, occupancy, building drawings (original and additions), historical energy use including a minimum of two years of fuel and electrical bills, etc. It can be used to determine the level of audit needed or if retro-commissioning should be undertaken.

Bituminous coal: A dense coal, usually black, sometimes dark brown, often with well-defined bands of bright and dull material, used primarily as fuel in steam-electric power generation, with substantial quantities also used for heat and power applications in manufacturing and to make coke. Bituminous coal is the most abundant coal in active U.S. mining regions. Its moisture content usually is less than 20%. The heat content of bituminous coal ranges from 21 to 30 million BTU per ton on a moist, mineral-matter-free basis. The heat content of bituminous coal consumed in the United States averages 24 million BTU per ton, on the as-received basis (i.e. containing both inherent moisture and mineral matter).

British Thermal Unit: The British thermal unit (BTU or Btu) is a traditional unit of energy equal to about 1.06 kilojoules. It is approximately the amount of energy needed to heat one pound (0.454 kg) of water 1 °F (0.556 °C). It is used in the power, steam generation, heating and air conditioning industries. In North America, the term "BTU" is used to describe the heat value (energy content) of fuels, and also to describe the power of heating and cooling systems. When used as a unit of power, BTU per hour (BTU/h) is the correct unit, though this is often abbreviated to just "BTU."

Capital Cost: The cost of field development, plant construction, and the equipment required for industry operations.

Climate Change: A term used to refer to all forms of climatic inconsistency, but especially to significant change from one prevailing climatic condition to another. In some cases, "climate 20 change" has been used synonymously with the term "global warming;" scientists, however, tend to use the term in a wider sense inclusive of natural changes in climate, including climatic cooling.

Coal: A readily combustible black or brownish-black rock whose composition, including inherent moisture, consists of more than 50% by weight and more than 70% by volume of carbonaceous material. It is formed from plant remains that have been compacted, hardened, chemically altered, and metamorphosed by heat and pressure over geologic time. It is estimated that Alaska holds about 15% of the world's coal resources, amounting to 170 billion identified short tons. Major coal provinces include Northern Alaska, the Nenana area, Cook Inlet – Matanuska Valley, the Alaska Peninsula, and in the Gulf of Alaska and the Bering River. Alaska coals exhibit low metallic trace elements, good ash-fusion characteristics, and low nitrogen content making them favorable for meeting environmental constraints on combustion in power plants.

Cogeneration System: A system using a common energy source to produce both electricity and thermal energy for other uses, resulting in increased fuel efficiency.

Combined Cycle: An electric generating technology in which electricity is produced from otherwise lost waste heat exiting from one or more gas (combustion) turbines. The exiting heat is routed to a conventional boiler or to a heat recovery steam generator for utilization by a steam turbine in the production of electricity. This process increases the efficiency of the electric generating unit.

Combustion: Chemical oxidation accompanied by the generation of light and heat.

Commercial Sector: An energy-consuming sector that consists of service-providing facilities and equipment of businesses; Federal, State, and local governments; and other private and public organizations, such as religious, social, or fraternal groups. The commercial sector includes institutional living quarters. It also includes sewage treatment facilities. Common uses of energy associated with this sector include space heating, water heating, air conditioning, lighting, refrigeration, cooking, and running a wide variety of other equipment. Note: This sector includes generators that produce electricity and/or useful thermal output primarily to support the activities of the above-mentioned commercial establishments.

Consumer (energy): Any individually metered dwelling, building, establishment, or location.

Diesel #1: Also known as DF1 or Jet A. Diesel #1 is commonly used as heating fuel throughout most of northern rural AK. Diesel #1 has a lower gel temperature than Diesel #2 which is sold for heating fuel in warmer climates. Diesel #1 is same fuel the refineries sell as Jet fuel (Jet A), and in many tank farms it is stored as Jet A until sold as DF1.

Diesel #2: Is commonly used throughout the US. In Alaska, it is used for marine and highway diesel as well as heating fuel in warmer regions. Diesel #2 is preferred over #1 where it is warm enough as it has higher energy content.

Diesel Fuel: A fuel composed of distillates obtained in petroleum refining operation or blends of such distillates with residual oil used in motor vehicles. The boiling point and specific gravity are higher for diesel fuels than for gasoline.

Distillate Fuel Oil: A generic name for a refined petroleum product. It can refer to diesel, heating fuel or jet fuel.

Electric Meter, or Watt-hour Meter: Electric Meter, or Watt-hour Meter (also known as The Energy Detective or TED meters) is an instrument that measures the amount of electric energy used by a consumer. The meter is calibrated in kilowatt-hours.

Electricity: A form of energy characterized by the presence and motion of elementary charged particles generated by friction, induction, or chemical change.

Energy Balance: The difference between the total incoming and total outgoing energy. When the energy budget is balanced, the system neither gains nor loses energy.

Energy Information Agency (EIA): An independent agency within the U.S. Department of Energy that develops surveys, collects energy data, and analyzes and models energy issues. Website: http://www.eia.doe.gov/

Fuel: Any material substance that can be consumed to supply heat, power, or mechanical energy. Included are petroleum, coal, and natural gas (the fossil fuels), and other consumable materials such as biomass.

Biodiesel (Fish Oil)	121,000 BTU/Gal
Coal (Healy)	7,900 Btu/lb
Crude Oil	138,000 Btu/gal
Diesel #1	132,000 Btu/gal
Diesel #2	138,000 Btu/gal

Electricity	3,412 Btu/k/Wh
Garbage	4,800 Btu/lb.
Gasoline	124,000 Btu/gal
Natural Gas	1,000 Btu/cf
Paper	7,500 Btu/lb
Propane	92,000Btu/gal
Wood (Birch)	24.2 MMBtu/cord
Wood (Birch))	8,300 Btu/dry lb.
Wood (Spruce)	15.9 MMBtu/cord
Wood (Spruce)	8,100 Btu/dry lb.

Gallon: A volumetric measure equal to four quarts (231 cubic inches) used to measure fuel oil.

Gas: A non-solid, non-liquid combustible energy source that includes natural gas, coke-oven gas, blast-furnace gas, and refinery gas.

Grid: The layout of an electrical distribution system.

Heating Degree Days (HDD): A measure of how cold a location is over a period of time relative to a base temperature, most commonly specified as 65 degrees Fahrenheit. The measure is computed for each day by subtracting the average of the day's high and low temperatures from the base temperature (65 degrees), with negative values set equal to zero. Each day's heating degree days are summed to create a heating degree day measure for a specified reference period. Heating degree days are used in energy analysis as an indicator of space heating energy requirements or use.

Hydroelectric Power: The use of flowing water to produce electrical energy.

Installed Capacity: The maximum theoretical production output of a plant, based either on nameplate capacity or actual (practically determined) capacity.

Kilowatt-Hour (kWh): A unit of energy equal to one kW applied for one hour; running a one kW hair dryer for one hour would dissipate one kWh of electrical energy as heat. Also, one kWh is equivalent to one thousand watt hours.

Kilowatt (kW): One thousand watts of electricity (See Watt).

Load (Electric): Amount of electricity required to meet customer demand at any given time.

MCF: One thousand cubic feet.

Megawatt (MW): One million watts of electricity (See Watt).

Microgrid: A microgrid is a small-scale power grid that can operate independently or in conjunction with the area's main electrical grid.

Microturbines: Microturbines combine heat and power (CHP), or cogeneration, for an efficient and clean approach to generating electric power and useful thermal energy from a single fuel source. CHP is used to replace or supplement conventional separate heat and power (i.e., central station electricity available via the grid and an onsite boiler or heater). Every CHP application involves the generation of electricity and the recovery of otherwise wasted thermal energy. Therefore, CHP provides greater energy efficiency and environmental benefits than separate heat and power. CHP systems achieve fuel use efficiencies of 60 to 90 percent, compared to a typical separate heat and power efficiency range of 45 to 55 percent. This improvement in efficiency translates to energy cost savings from reduced fuel used, reduced emissions of greenhouse gases and other regulated air pollutants, increased electricity-supply reliability and power quality, and reduced grid congestion and transmission and distribution losses.

In addition to burning liquid fuels such as diesel, kerosene, jet fuel, and liquid biofuels, microturbines can burn almost any carbon-based gaseous fuel: natural gas, propane, sour gas, sweet gas, well casing gas, flare gas, methane and other waste gases to create renewable power and heat. Waste material buried in landfills biodegrades over time to produce methane, carbon dioxide, and other gases. Treatment of domestic wastewater, agricultural waste and food processing waste using anaerobic digestion also produces methane and other gases. Many sites flare these waste gases; or worse yet vent them directly into the atmosphere. Methane has a greenhouse gas impact on the atmosphere that is 21 times that of carbon dioxide, and burning methane in a flare completely wastes its energy value.

Natural Gas: Gas in place at the time that a reservoir was converted to use as an underground storage reservoir in contrast to injected gas volumes.

O&M: Operations and maintenance

Peak: The amount of electricity required to meet customer demand at its highest. The summer peak period begins June 1st and ends September 30th, and the winter peak period begins December 1st and ends March 31st.

Petroleum: A broadly defined class of liquid hydrocarbon mixtures. Included are crude oil, lease condensate, unfinished oils, refined products obtained from the processing of crude oil,.and natural gas plant liquids. Note: volumes of finished petroleum products include non-hydrocarbon compounds, such as additives and detergents, after they have been blended into the products.

Power: The rate of producing, transferring, or using energy that is capable of doing work, most commonly associated with electricity. Power is measured in watts and often expressed in kilowatts (kW) or megawatts (MW).

Power Cost Equalization Program (PCE): Participating utilities receive state funding to reduce the charge to consumers in rural areas where prices can be three to five times higher than prices in urban areas.

Rankine Cycle: Converts heat into power, the heat is supplied in a closed loop of water. Organic Rankine Cycle uses a liquid with lower boiling temperature.

Refinery: An installation that manufactures finished petroleum products from crude oil, unfinished oils, natural gas liquids, other hydrocarbons, and oxygenates.

Renewable Energy Fund (REF): Established by the Alaska State Legislature and administered by the Alaska Energy Authority to competitively award grants to qualified applicants for renewable energy projects.

Renewable Energy Resources: Energy resources that are naturally replenishing but flow-limited. They are virtually inexhaustible in duration but limited in the amount of energy that is available per unit of time. Renewable energy resources include biomass, hydro, geothermal, solar, wind, ocean thermal, wave action, and tidal action.

Rural Utility Business Advisor (RUBA) Program: The goal of the RUBA program is to increase the managerial and financial capacity of rural water and wastewater utility providers. The program is advisory only; travel and assistance is at the request of local utility staff. The program offers capacity building assistance to rural utilities throughout all regions of the state. One-on-one or small group training in the community is provided by RUBA staff for the local utility staff. Website: http://commerce.alaska.gov/dnn/dcra/RuralUtilityBusinessAdvisorProgramRUBA.aspx

Smart Grid: A smart grid is a modernized electrical grid that uses analog or digital information and communications technology to gather and act on information, such as information about the behaviors of suppliers and consumers, in an automated fashion to improve the efficiency, reliability, economics, and sustainability of the production and distribution of electricity. It also allows utility operators to shut off power to portions of the grid while making repairs.

Smart Meters: Smart meters are meters that identify energy consumption in more detail than a conventional electric or Watt Hour meter). They have the ability to communicate information via a secured network back and forth between the end user and the utility provider. This allows the utility to close portions of the grid as needed for repairs or maintenance without shutting off the entire system.

Space Heating: The use of energy to generate heat for warmth in housing units using space-heating equipment. It does not include the use of energy to operate appliances (such as lights, televisions, and refrigerators) that give off heat as a byproduct.

Transmission System (Electric): An interconnected group of electric transmission lines and associated equipment for moving or transferring electric energy in bulk between points of supply and points at which it is transformed for delivery over the distribution system lines to consumers, or is delivered to other electric systems.

Turbine: A machine for generating rotary mechanical power from the energy of a moving force (such as water, hot gas, wind, or steam). Turbines convert the kinetic energy to mechanical energy through the principles of impulse and reaction, or a mixture of the two.

U.S. Department of Energy (DOE): Oversees programs, such as Wind Powering America, with the mission to advance national, economic, and energy security; promote innovation; and ensure environmental responsibility. Website: http://www.energy.gov/

Waste to Energy or Energy from Waste: Waste-to-energy (WtE) or energy-from-waste is the process of generating energy in the form of electricity and/or heat from the incineration of waste. WtE is a form of energy recovery. Most WtE processes produce electricity and/or heat directly through combustion, or produce a combustible fuel commodity, such as methane, methanol, ethanol or synthetic fuels.

Watt (Electric): The electrical unit of power. The rate of energy transfer equivalent to one ampere of electric current flowing under a pressure of one volt at unity power factor.

Watt (Thermal): A unit of power in the metric system, expressed in terms of energy per second, equal to the work done at a rate of one joule per second.

Watt hour (Wh): The electrical energy unit of measure equal to one watt of power supplied to, or taken from, an electric circuit steadily for one hour.

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Appendix A: Funding Opportunities for Energy Projects

FUNDING OPPORTUNITIES FOR ENERGY PROJECTS

The majority of energy funding resources accessed for Alaska projects come from either the State of Alaska or from U.S. Department of Energy. AHFC funds energy efficiency projects for residences, businesses, and buildings owned by municipalities and educational entities, such as the University of Alaska Anchorage. AEA provides energy audit services to commercial and governmental agencies, renewable energy funds, rural power systems upgrades, bulk fuel construction funds and alternative energy and energy efficiency development programs. AEA also provides economic assistance to rural customers where kilowatt hour charges for electricity are three to five times higher than more urban areas of the state.

Private foundations and corporations also provide funds for smaller projects, some of which can be energy improvements, but most of which are capital funds for construction or reconstruction projects.

In the table that follows, funding sources are listed by type of project and then funding agency. The description of the type of project eligible is included as well as if the funding eligibility is dependent on economic status of the applicant.

Program	Funding Agency	Description of Funding Opportunity	Restrictions for Eligibility	Comments
Direct Aid				
Power Cost Equalization	Alaska Energy Authority http://www.akenergyauthority.org/	To provide economic assistance to customers in rural areas of Alaska where the kilowatt-hour charge for electricity can be three to five times higher than the charge in more urban areas of the state. PCE only pays a portion of approximately 30% of all kWh sold by the participating utilities.		AEA determines eligibility of community facilities and residential customers and authorizes payment to the electric utility. Commercial customers are not eligible to receive PCE credit. Participating utilities are required to reduce each eligible customer's bill by the amount that the State pays for PCE.
Low Income Home Energy Assistance Program -- LIHEAP	Department of Health and Social Services http://liheap.org/?page_id=361	Fuel assistance for low-income families.	Income-based	

Program	Funding Agency	Description of Funding Opportunity	Restrictions for Eligibility	Comments
Energy Efficiency Improvements				
Alaska Energy Efficiency Revolving Loan Fund Program	Alaska Housing Finance Corporation http://www.ahfc.us	Provides financing for permanent energy-efficient improvements to buildings owned by regional educational attendance areas, the University of Alaska, the State or municipalities in the state. Borrowers obtain an investment grade audit as the basis for making cost-effective energy improvements, selecting from the list of energy efficiency measures identified. All of the improvements must be completed within 365 days of loan closing.	Public facilities	
Commercial Energy Audit Program	Alaska Energy Authority http://www.akenergyauthority.org/	Funding for energy efficiency audits for privately owned commercial buildings across Alaska. The program provides reimbursements of qualified commercial energy audits for privately owned commercial buildings up to 160,000 square feet. The maximum reimbursement is set by the building size and complexity and ranges from $1,800 for buildings under 2,500 square feet up to $7,000 for buildings from 60,000 and above.	Owners of commercial buildings	This funding was available in 2013/2014. Check website for notice of future funding availability. Application period is typically November to December.

Program	Funding Agency	Description of Funding Opportunity	Restrictions for Eligibility	Comments
Energy Efficiency Interest Rate Reduction Program	Alaska Housing Finance Corporation http://www.ahfc.us	AHFC offers interest rate reductions when financing new or existing energy-efficient homes or when borrowers purchase and make energy improvements to an existing home. Any property that can be energy rated and is otherwise eligible for AHFC financing may qualify for this program. Interest rate reductions apply to the first $200,000 of the loan amount. A loan amount exceeding $200,000 receives a blended interest rate rounded up to the next 0.125 percent. The percentage rate reduction depends on whether or not the property has access to natural gas.	Energy Rating Required	
Alaska Home Energy Rebate Program	Alaska Housing Finance Corporation http://www.ahfc.us	Homeowners may receive up to $10,000 for making energy-efficient improvements. Based on before and after energy audits. Rebate is based on final energy rating audit outcome.		Upfront cost for energy audit.
Second Mortgage Program for Energy Conservation	Alaska Housing Finance Corporation http://www.ahfc.us	Borrowers may obtain a second mortgage to finance home improvements or purchase a home in conjunction with an assumption of an existing AHFC loan and make repairs if need be.		The maximum loan amount is $30,000. The maximum loan term is 15 years. The interest rate is the Taxable Program or Rural Owner-Occupied, 15-year interest rate plus 0.375.

Program	Funding Agency	Description of Funding Opportunity	Restrictions for Eligibility	Comments
Village Energy Efficiency Program	Alaska Energy Authority http://www.akenergyauthority.org/	Upgrades are performed are8 in rural Alaskan community buildings. There are currently three phases of funding with Phase II communities recently completed. Community selection was based on the status of the respective village's Rural Power System Upgrade (RPSU). The community either recently received or is slated to receive a new power system.		
Weatherization Program	Alaska Housing Finance Corporation http://www.ahfc.us	Weatherization programs have been created to award grants to nonprofit organizations for the purpose of improving the energy efficiency of low-income homes statewide. These programs also provide for training and technical assistance in the area of housing energy efficiency. Funds for these programs come from the US Dept. of Energy and AHFC.		
RurAL CAP Weatherization	RurAL CAP http://www.ruralcap.com	Rural Alaska Community Action Program, Inc. (RurAL CAP) manages a state program administered by Alaska Housing Finance Corporation that offers free weatherization services for low and middle-income residents in western and northern Alaska, the Municipality of Anchorage, and the City and Borough of Juneau. An Anchorage family of four with income up to $87,800 qualifies.	An income-based program	

Program	Funding Agency	Description of Funding Opportunity	Restrictions for Eligibility	Comments
RurAL CAP Energy Wise	RurAL CAP http://www.ruralcap.com	The Energy Wise Program engages rural Alaskan communities in behavior change practices resulting in energy efficiency and energy conservation. This tested model uses community-based social marketing to save energy – a multi-step educational approach involving residents in changing home energy consumption behaviors. Locally hired crews are trained to educate community residents and conduct basic energy efficiency upgrades during full-day home visits. Through Energy Wise, rural Alaskans reduce their energy consumption, lower their home heating and electric bills, and save money.	No income restrictions	Communities receive the following: ten locally hired and trained crew members; on site "launch week" by a RurAL CAP staff for hiring and training of local crews; one community energy fair to engage community residents and organizations. Households receive: Full day home visit from a trained, locally hired crew; household energy consumption and cost assessment conducted with the resident; education on energy cost-saving strategies; an estimated $300 worth of basic, home energy efficiency supplies installed.

Program	Funding Agency	Description of Funding Opportunity	Restrictions for Eligibility	Comments
Infrastructure Development				
Alternative Energy & Energy Efficiency Development Program	Alaska Energy Authority http://www.akenergyauthority.org/	AEA's Alternative Energy and Energy Efficiency programs promote: 1.) Use of renewable energy resources and local sources of coal and natural gas alternatives to diesel-based power, heat, and fuel production; 2.) Measures to improve efficiency of energy production and end use.		
Bulk Fuel Construction Program	Alaska Energy Authority/Denali Commission http://www.akenergyauthority.org/	With substantial contributions from the Denali Commission, the bulk fuel upgrades program provides funding for the design/engineering, business planning and construction management services to build code-compliant bulk fuel tank farms in rural communities. The bulk fuel upgrade retrofit and revision program, with financial support from the Denali Commission, provides funding for repairs to enable affected communities to continue to receive fuel.		

Program	Funding Agency	Description of Funding Opportunity	Restrictions for Eligibility	Comments
Emerging Energy Technology Fund	Alaska Energy Authority http://www.akenergyauthority.org/	The Authority may make grants to eligible applicants for demonstration projects of technologies that have a reasonable expectation to be commercially viable within five years and that are designed to: test emerging energy technologies or methods of conserving energy; improve an existing energy technology; or deploy an existing technology that has not previously been demonstrated in Alaska.		Eligible applicants: An electric utility holding a certificate of public convenience and necessity under AS 42.05; an independent power producer; a local government, quasi-governmental entity, or other governmental entity, including tribal council or housing authority; a business holding an Alaska business license; or a nonprofit organization.
Renewable Energy Fund	Alaska Energy Authority http://www.akenergyauthority.org/	This program funds solar water heat, photovoltaics, landfill gas, wind, biomass, hydroelectric, geothermal electric, fuel cells, geothermal heat pumps, CHP/cogeneration, hydrothermal, waste heat, transmission or distribution infrastructure, anaerobic digestion, tidal energy, wave energy, fuel cells using renewable fuels, geothermal direct-use		

Program	Funding Agency	Description of Funding Opportunity	Restrictions for Eligibility	Comments
Rural Power Systems Upgrades	Alaska Energy Authority/Denali Commission http://www.akenergyauthority.org/	Upgrades may include efficiency improvements, powerhouse upgrades or replacements, line assessments, lines to new customers, demand-side improvements and repairs to generation and distribution systems.		
Tier 1 Grant Program	Rasmuson Foundation http://www.rasmuson.org	Grants for capital projects, technology updates, capacity building, program expansion and creative works, including building construction/renovation/restoration, technology upgrades in community facilities, and capacity building grant support.		
Federal Funding Opportunities				
EERE Tribal Energy Program	U.S. Department of Energy DOE	Various grants for energy efficiency and renewable energy projects, including: Biomass, energy efficiency, geothermal, hydropower, solar		

Program	Funding Agency	Description of Funding Opportunity	Restrictions for Eligibility	Comments
	http://energy.gov/eere/office-energy-efficiency-renewable-energy	photovoltaics, solar water heat, wind, and other renewable energy projects.		
Rural Utilities Service Assistance to High Energy Cost Rural Communities Program	U.S. Department of Agriculture USDA http://www.rurdev.usda.gov/UEP_Our_Grant_Programs.html	Funds may be used to acquire, construct, extend, upgrade, or otherwise improve energy generation, transmission, or distribution facilities and to establish fuel transport systems that are less expensive than road and rail.		
Renewable Energy System and Energy Efficiency Improvement Guaranteed Loan and Grant Program	USDA Rural Development – Rural Energy for America Program (REAP) http://www.rurdev.usda.gov/BCP_ReapResEei.html	The Rural Energy for America Program (REAP) provides financial assistance to agricultural producers and rural small businesses in rural America to purchase, install, and construct renewable energy systems; make energy efficiency improvements to non-residential buildings and facilities; use renewable technologies that reduce energy consumption; and participate in energy audits, renewable energy development assistance, and feasibility studies.		