Native Village of Shishmaref

Energy Efficiency Upgrades for The Clinic and the Tannery and Wind Energy for Power to the Tannery

Final Report

Department of Energy

Energy Efficiency and Renewable Energy

Title: Weatherization and Wind Energy

Location: Shishmaref, Alaska

Prepared for: Department of Energy

Prepared by: Native Village of Shishmaref

P.O Box 72110

Shishmaref, Alaska 99772

Date: May 8, 2017

TABLE OF CONTENTS

Executive Summary

The Native Village of Shishmaref was awarded Strategic Technical Assistance Response Team(START) from the U.S Department of Energy Office of Indian Energy Policy and Programs and the Denali Commission in 2013. In 2010, Shishmaref population was 563 and increased to 605 residents by 2012.

The Shishmaref Village Council opened Shishmaref Traditional Industries, Inc. with a Tannery in 1990. They added a cottage industry to produce seal skin slippers and complement the tannery in 1992. The business did well until late 2011, when the high cost of energy began eating into profits, making it cost prohibitive to operate these businesses. Currently, the tannery has no power or no heat. An investment-grade energy audit was completed with START support, and the community opted to use a portion of their $250,000.00 START Tribal Energy Program (TEP) grant to fund the energy-saving measures recommended by the auditor.

The high cost of heat and power has stifled economic development in Shishmaref Land constraints complicate energy development, particularly wind, and Alaska Village Electric Cooperative (AVEC) supports renewable installations for heat projects but limits grid-connected renewable technologies to a total of 14 kW for the whole community.

In 2010 and 2011, the Native Village of Shishmaref had VEEP- and EECBG funded energy efficiency retrofits completed on several buildings in the community. The START team funded Richard S. Armstrong, PE, LLC to measure the actual performance of the energy conservation measures implemented during those retrofits against the projected performance.

The Native Village of Shishmaref (Shishmaref) will complete weatherization retrofits to two community buildings, the Clinic and the Tannery, based on recent energy audits. Located 5 miles from mainland, 126 miles north of Nome and 100 miles south of Kotzebue, Shishmaref sits on Sarachief Island in the Chuckchi Sea. As such, Shishmaref experiences a transitional climate between the frozen Arctic and the continental Interior. Summers can be foggy, with average temperatures ranging from 47 to 54 degrees farenheit, winter temperatures average -12 to 2 degrees farenheit. With heating fuel costs of almost $7/gallon, the goal of this project is to reduce energy costs at the Clinic and the Tannery by at least 30 to 50% through energy efficiency and weatherization measures and through the installation of a residential-size wind turbine to supplement power for the Tannery building.

1.0 Background

The current population of Shishmaref is 605, up from 563 in 2010(DCCED 2012). Shishmaref has been inhabited for 4,000 years, but in July of 2002 considered relocation. Rising temperatures and a reduction in sea ice along the coast are allowing higher storm surges that now reach shore. Thawing of permafrost makes the shoreline more vulnerable to erosion. The town's homes, water system and infrastructure are being undermined. Fourteen homes and the National Guard Armory had to be moved in 1997 when a severe storm eroded 30 feet of the north shore. Five additional homes had to be moved in July 2002. And the storms continue to erode the shoreline with an average of three to five feet per year. Eleven potential sites were thoroughly vetted, and ruled out one by one. The community recently decided to remain in place while taking measures to stall the inevitable. The Army Corps of Engineers has been provided assistance to build a seawall along the coast to slow erosion.

The Alaska Village Electric Cooperative provides power to the community at the following price:

Residential/Community Facilities/Small Commercial (1-700)	$.6077/kWh
Residential/Community Facilities/Small Commercial (701+)	$.5077/kWh
PCE Rate*	$.4127/kWh

*PCE = Power Cost Equalization – applies to first 500 kWhs of Residential usage and to all Community Facility usage to a limit of current population x 70.

Homes and businesses are heated by diesel fuel. Homes are designed for warmer climates and built with inefficient boilers installed. The average home uses about 200 gallons of fuel/month in winter – 55 gallons every 5-7 days. Heating fuel costs almost $7/gallon. Extreme energy costs in remote Alaska makes economic development difficult. Shishmaref Traditional industries was no exception. The high cost to heat and power the local Tannery, established in 1985, forced the village council to shut down the otherwise successful business in 2011.

Project Objectives

The goal of this project is to reduce energy costs at the Clinic and Tannery by at least 30 to 50% through energy efficiency and weatherization measures and through the installation of a residential sized wind turbine to supplement power for the Tannery.

Tasks Performed

Task 1.0 Tannery- Energy Efficiency Measures

One EEM considered for this building is a re-configuration of its internal spaces to reduce heating requirements. Another is to retrofit the lighting to reduce the cost of electricity use, replace double doors to reduce air leakage, add blowfill insulation, add 2" insulation and create a village "energy champion", provide 2 days of training to implement and sustain ECM's.

The following energy efficiency measures were completed as part of this project.

Rank	Feature	Improvement Description
1	Lighting- Power Retrofit: Occupied & heating spaces	Replace T8-32 watt lamps with 31 FLUOR (2) T8 4' F32T* 25W Energy-Saver Instant StdElectronic
2	Lighting – Power Retrofit: Infrequently used spaces (mech rm, tank rm, sto)	Replace T8-32 watt lamps with 31 FLUOR (2) T8 4' F32T* 25W Energy-Saver Instant StdElectronic
3	Lighting- Power Retrofit: Unheated spaces need for moving between heated spaces	Replace T8-32 watt lamps with 31 FLUOR (2) T8 4' F32T* 25W Energy-Saver Instant StdElectronic
4	Air-Tightening: Replace double entry doors	Replace double entry doors with new, pre-hung, insulated doors to reduce air leakage by 480 cfm at 75 Pascals

6	Demo and build-out the

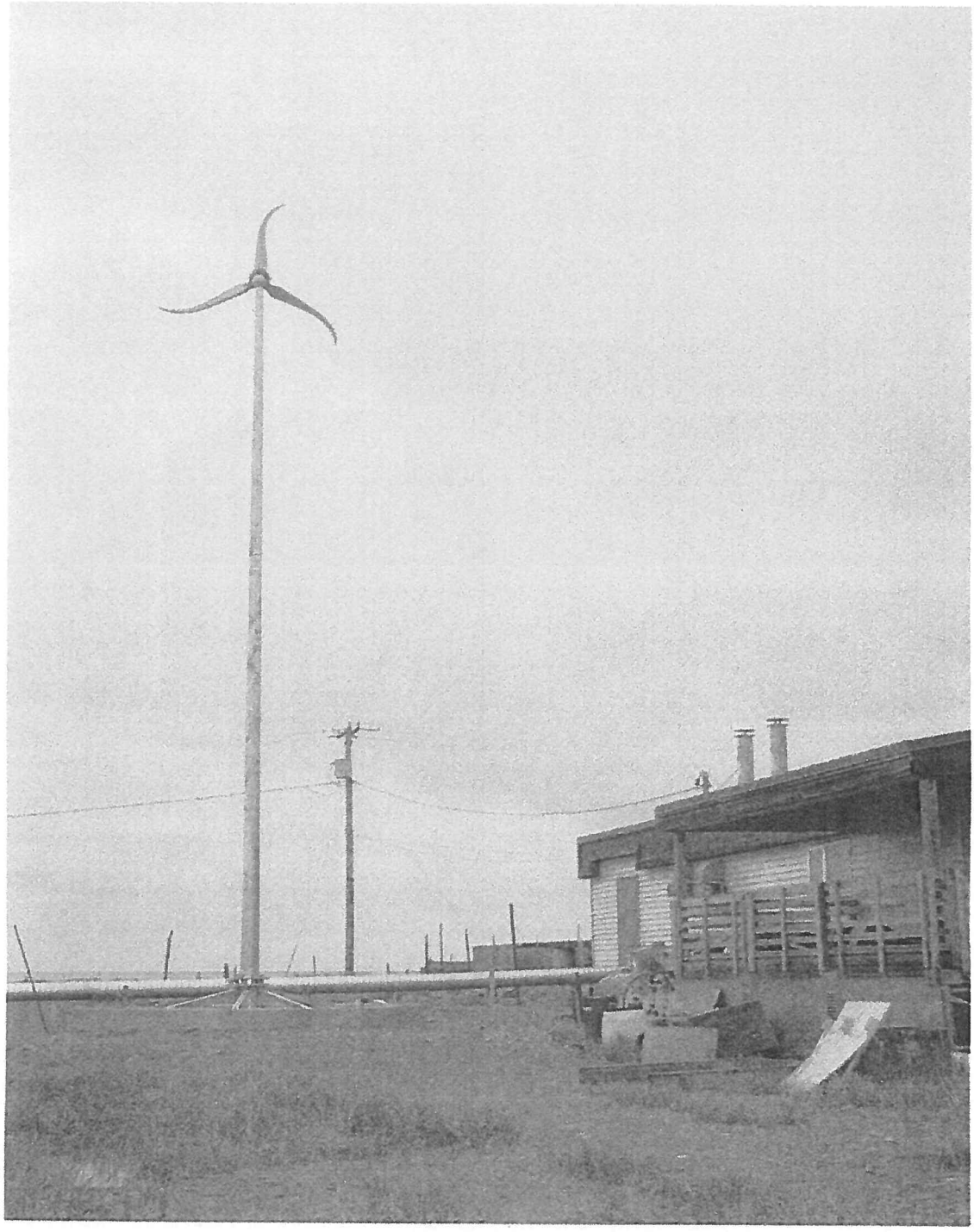
Task 2.0 Clinic- Energy Efficiency Measures

Creating a village "Energy Champion" component to an existing staff person's job description can provide additional savings at very little cost. This person should be trained to perform a monthly walk-through of each building using an Energy Checklist. Savings from this activity can vary from zero to 10% of the buildings annual energy cost.

The following energy efficiency measures will be completed as part of this project.

Rank	Feature	Improvement Description
1	Setback Thermostat: Main Building – FT Baseboard	Implement a Heating Temperature Unoccupied Setback to 64. Deg F for the Main Building – FT Base-board space.
2	Air Tightening	Perform air sealing to reduce air leakage by 1500 cfm at 75 Pascals
3	Exterior Door: Entry Doors	Remove existing door and install standard pre-hung U-0 16 insulated door, including hardware.
4	Ceiling w/ Attic: Main Building	Add R-42 blown cellulose insulation to attic with Standard Truss.

Task 3.0 Install Residential Sized Wind Turbine near Tannery



Task 3.1 Selected site for proximity to Tannery and proper geology for installation

Task 3.2 Obtain permitting approvals

- FAA
- UFWS
- SHPO

Task 3.3 Monitor wind turbine production monthly and compare electric usage of Tannery to previous years.

The productions and costs of energy through the residential wind turbine place near the Tannery is shown below in the table. All the data results were graphed by the skystream 2.0 application installed in the laptop and connected to the wind turbine through wifi.

With the next pictures, there are the lights that were changed in the Tannery to more energy efficient light bulbs. With the data results you can see the difference between with the light bulbs before.

Description of Activities Performed

Tannery Weatherization Project

The Tannery Weatherization Project was done at the Shishmaref Tannnery, where they have lowered the ceiling, installed new ventilation, changed the lights bulbs to more energy efficient light bulbs, and installed new exterior doors. The Shishmaref IRA Council authorized and hired 2 carpenters, 2 laborers, 1 electrician, and 1 plumber to complete this project.

Tannery Wind Turbine Project

The Wind Turbine Project was done at the Shishmaref Tannery. A residential wind turbine was ordered from Susitna Energy Systems located in Anchorage, Alaska. The wind turbine came to Shishmaref by plane, so it was grounded in Shishmaref piece by piece. The Shishmaref IRA authorized and hired 2 laborers, and 2 carpenters to put together and put in place the Wind Turbine near the Shishmaref Tannery. Kirk Garoutte, owner of Susitna Energy Systems led the crew through the installation following electrical work by a certified electrician recommended by Susitna Energy Systems. After the wind turbine was put in place, it then was turned on to produce energy to the Shishmaref Tannery. The wind turbine has been very effective since.

Clinic Energy Efficiency Measures

A setback thermostat in the Main building FT- Baseboard was installed to implement a heating temperature unoccupied setback to 64.0 degree F for the Main building FT BNase-board space.

Air tightening was performed and air sealing to reduce air leakage by 1500 cfm at 75 pascals. An exterior standard pre-hung U-0. 16 door was placed at the entry to remove existing door. The ceiling with the attic in the main building was improved with adding R-42 blown cellulose insulation to attic with Standard Truss.

Overall, these three projects have been successful. The changes/problems throughout the grant were dramatic cost changes with the Reznor Oil Heater that was proposed for the Shishmaref Tannery. It was never installed because the cost of the heater and shipping to Shishmaref Tannery landed has gone sky high. We also had to extend the grant period to finish up projects for the Tannery Weatherization Project. The material and supplies for the Tannery Weatherization project were ordered from a building supply store based in Anchorage, Alaska. The materials took longer than expected to be shipped to Shishmaref, Alaska.

The Outcomes of the project tasks completed were very effective. The Wind Turbine installed near the Tannery has changed the energy cost and is more energy efficient. The graphs and numbers of the total monthly charges and usage of the Tannery electricity has showed positive impact with lower costs of monthly charges.

Acronyms and Abbreviations

BSHC: Bering Strait Housing Corporation

DOE: Department of Energy

PCE: Power Cost Equalization

Tables

SHISHMAREF SKYSTREAM WIND PROJECT								
	Skystream Production	AVEC Usage		Skystream Production	AVEC Usage		Skystream Production	AVEC Usage
	2016			2015			2014	
January	488	844			607			
February	201	540			647			
March	64	730			752			
April	137	531			661			
May	487	109			504			
June	492	0			468			
July	529	0			450			
August	186	3			516			
September	204	165			828			
October	0	124			950			878
November	0	318		392	914			842
December	0			56	1157			703

Dec-15 Meter on Tannery changed to reflect energy going both ways.

Sep-16 Non-firm rate $.2370

AVEC metering shows Tannery Meter had 433 kWhs returned to the grid