DOE Award Number:	DE-FG36-04GO15174, M002
Name of Recipient:	Upper Skagit Indian Tribe
Project Title:	Strategic Energy Plan for New and Existing Lands
Technical Contact:	Carol Benskin
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DOE Project Officer:	Lizana K. Pierce

Final Report

EXECUTIVE SUMMARY

The Tribe was honored with a grant to develop a Strategic Energy Plan for the two sites of the Upper Skagit Indian Tribe. Bow Hill Complex is the economic site of the Tribe; whereas, the Helmick Road Reservation is the community and governmental site of the Tribe. The two sites, both located in Skagit County Washington, have very different needs and economic footings.

The Upper Skagit Indian Tribe contracted with RIDOLFI Inc. to provide strategic energy planning services in support of the Tribe's efforts to develop a **Strategic Energy Plan for new and existing lands** at the Helmick Road Reservation and at the Bow Hill Complex. This plan incorporates findings from the Energy Efficiency Improvement Projects Assessment and Renewable Energy Resource Assessment reports for both the Helmick Road Reservation and the Bow Hill Complex previously generated by RIDOLFI Inc. using these grant funds.

Section 1 of the Strategic Energy Plan describes the scope of the Plan and describes the work previously completed in support of the Tribe's energy planning efforts.

Section 2 describes the energy vision and goals for the Tribe, including Green Power and Carbon Credits.

Section 3 provides the summary of the energy baseline assessment for both Helmick Road Reservation and the Bow Hill Complex. This assessment describes energy sources such as solar and geothermal heat pumps, energy use and costs, the environmental impacts, a resources assessment, and alternatives screening.

Section 4 is the Action Plan that prioritizes and phases the implementation of energy efficiency and renewable energy generation projects originally defined in the Energy Efficiency Improvement Project and Renewable Energy Resource Assessment reports. It was found that even though it is possible to retrofit energy efficient infrastructure onto the existing buildings; it is more economically feasible for new development.

Section 5 concludes the report with a summary of the estimated annual greenhouse emission reduction targets and the capital costs that would be offset by energy savings by the phased implementation of the recommended actions defined in the Action Plan for both the Helmick Road Reservation and the Bow Hill Complex.

The Tribe had left over funds. With permission from DOE, they were used to generate the Draft Energy Conservation Code. The Draft Energy Conservation Code will require review and comment and is ultimately intended to become a section of an updated integrated sustainable development code for the Tribe.

PROJECT OVERVIEW

The Tribe has a long-term goal to strive for energy self-sufficiency. The Tribe is supporting this goal by incorporating upfront planning of energy sources and green-building practices for new development and for phasing in energy efficient technology into the facilities on the existing lands as funding becomes available. This strategic energy plan will be the foundation to actualize this goal.

OBJECTIVES

The Tribe's objective in obtaining this grant was to have produced a strategic energy plan that would be comprehensive incorporating the Tribe's baseline evaluation, vision, and suggest an action plan. The actual accomplishments were: 1) a resource assessment that reports results from an energy and conservation audit for existing facilities and identifies all possible energy sources including renewable energy opportunities on and near Tribal lands; 2) a prioritized ranking of energy efficiency improvement projects assessment for existing facilities that includes identification of cost, revenues, power purchase options and agreements, and capitalization; and 3) a strategic energy plan for energy self-sufficiency and potential energy developments in relationship to energy use, demographics, and physical characteristics with proposed energy sources. In addition, the Tribe obtained a draft Energy Conservation Code.

DESCRIPTION OF ACTIVITIES PERFORMED

1. Hired the consulting firm RIDOLFI, Inc. based in Seattle WA.

2. In order to develop an energy strategy that will promote the economic, environmental, and cultural goals of the Tribe, it was necessary to have a comprehensive understanding of how the Tribe currently uses energy, how it can most efficiently use existing energy resources, and what renewable energy resources are available to supplement or replace current energy sources. To accomplish this the consultant worked directly with the staff at both the Helmick Road Reservation and the Bow Hill Complex to complete the **Energy Efficiency Improvement Projects Assessment** per site.

   To complete the **Energy Efficiency Improvement Projects Assessment** the consultant conducted energy and conversation audits of the existing Tribal facilities and a sampling of the residences. These audits consisted of walk-through inspections of facilities and residences, input from Tribal staff regarding use and history of the individual facilities, input from Tribal housing staff regarding rehabilitation of residences, and review of electrical, natural gas, and propane records for one year. The **Energy Efficiency Improvement Projects Assessment** provided a list of energy efficiency options such as lighting, weatherization, and building design options.

3. A final report of the **Renewable Energy Resource Assessment** for the Helmick Road Reservation and the Bow Hill Complex was produced. The purpose of this **Renewable Energy Resource Assessment** was to identify potential renewable energy resources and opportunities on or near Tribal lands, and to evaluate the

technical and economic feasibility of implementing renewable energy generation options at Tribal facilities.

To complete the **Renewable Energy Resource Assessment** the consultant evaluated the solar, wind, water, geothermal, and biomass resources and the availability of the resource on or near Tribal lands. For each resource, the Assessment provided a general overview of the resource; a review of the available technologies for utilizing the resource; prioritized the renewable energy resources based on a number of factors including availability, site potential, estimated performance, and production capacity; then provided recommendations for carrying forward certain energy generation options for further evaluation in the Strategic Energy Plan. Basic information used to evaluate these resources and technologies, included capital cost, annual operation and maintenance costs, energy savings, and technical difficulty in installing and maintaining the system. Following a comparative ranking of all alternatives, a set of select, site-specific alternatives was further evaluated using detailed life-cycle cost analysis.

4. Presentations of the findings in the Energy Efficiency Improvement Projects Assessment reports and the Renewable Energy Resource Assessment reports were presented individually to the staff of the Bow Hill Complex and the different departments at the Helmick Road Reservation. These different presentations were narrowed down to personalize the material and the input from these presentations was used in the development of the **Strategic Energy Plan**.

5. Completed the Draft **Strategic Energy Plan** for presentation to Tribal Council. Council presentation of the Plan is being developed as a multi-part presentation to be presented as their Council agenda allows.

6. With the permission of the Department of Energy, the remaining funds were used to complete a Draft **Energy Conservation Code**. The Draft Energy Conservation Code is ultimately intended to become a section of an updated integrated sustainable development code for the Tribe.

CONCLUSIONS

Energy Efficiency Improvement Projects Assessment

An Energy Efficiency Improvement Projects Assessment was completed separately for the Helmick Road Reservation and the Bow Hill Complex. An energy and conversation audit was conducted and developed a list of projects that included the Building, the System involved, the Energy Efficiency Improvement Description, the Total Capital Cost, the Annual Energy Savings in kilowatts, the Annual Energy Cost Savings, and the Payback Period in years. There was an evaluation of thirty-five (35) projects for the Helmick Road Reservation and eleven (11) projects for the Box Hill Complex.

Of the Bow Hill projects nine (9) projects included upgrading to more efficient lighting and two (2) projects included installing occupancy sensors to decrease the use of energy on HVAC systems.

Of the thirty-five Helmick Road Reservation projects eight (8) include upgrading the HVAC systems when these HVAC systems needed replaced; ten (10) included

replacement to more efficient lighting; eleven (11) included conservation projects such as upgrading to more efficiency windows, roof treatment, rafter insulation, blower door testing and duct testing and sealing, and construction of overhang above south facing windows; and five (5) include miscellaneous projects such as installing vending miser, installing instantaneous water heaters, clearing obstruction in front of crawl spaces, and clearing out plants that are within 2-feet from the edge of the buildings.

The Tribe was able to obtain free Vending Misers from PSE (Puget Sound Energy) for all of the vending machines at the Helmick Road Reservation and at the Bow Hill Complexes.

The Tribal personnel at the Helmick Road Reservation pursued funding sources to accomplish some of these other tasks. The Tribe was also able to replace all lighting tasks at the Helmick Road Reservation through a Rebate Program with PSE. The Tribe is now tracking the energy bills of these facilities to track the change in energy use.

Using Tribal funds, other tasks were completed using this report as a guide to accomplishing more energy efficiency. When the CDC HVAC broke down and needed replacement, it was replaced with an energy efficient unit. The large two story south facing windows in the Administration Building were replaced with energy efficient windows.

Renewable Energy Resource Assessment

Based on the evaluation of the available renewable energy resources on or near Tribal lands, and on reasonable expectations for financially viable implementation, the energy resource options and technologies were ranked to produce the Renewable Energy Resource Assessment.

The steps achieved to create a list of Renewable Energy Resource Projects to further evaluate in the Strategic Energy Plan included a preliminary alternative screening that included a list of viable renewable energy technologies, the maximum system size (included categories Residential = 2,000-ft^2, Commercial = 5,000-ft^2, or Modular), and whether it is viable for retrofit or new projects. Refer to the list below:

Preliminary Alternative Comparison	Technology	Maximum System Size	Retro/New
Active Solar Space Cooling	Absorption Systems	Commercial	Retrofit
Active Solar Space Cooling	Absorption Systems	Commercial	New
Active Solar Space Cooling	Desiccant Systems	Commercial	Retrofit
Active Solar Space Cooling	Desiccant Systems	Commercial	New
Active Solar Space Heating	Air Based Collector Direct	Residential	New
Active Solar Space Heating	Liquid Based Collector w/HX	Commercial	Retrofit
Active Solar Space Heating	Liquid Based Collector w/HX	Commercial	New
Active Solar Space Heating	Liquid Based w/Hydronic Coils	Commercial	New
Active Solar Water Heating	Direct-Circulation	Residential	Retrofit
Active Solar Water Heating	Direct-Circulation	Residential	New
Active Solar Water Heating	Indirect-Circulation	Any	Retrofit
Active Solar Water Heating	Indirect-Circulation	Any	New
Geothermal Heat Pump	Horizontal Well Array	Any	Retrofit

Geothermal Heat Pump	Horizontal Well Array	Any	New
Geothermal Heat Pump	Vertical Well Array	Any	Retrofit
Geothermal Heat Pump	Vertical Well Array	Any	New
Passive Solar Lighting	Day lighting (clerestory, glazing)	Any	New
Passive Solar Lighting	Reflective Light Pipes	Any	Retrofit
Passive Solar Lighting	Reflective Light Pipes	Any	New
Passive Solar Lighting	Sunrooms	Any	Retrofit
Passive Solar Lighting	Sunrooms	Any	New
Passive Solar Space Heating and Cooling	Direct Gain	Any	New
Passive Solar Space Heating and Cooling	Sunrooms (Isolated gain)	Any	Retrofit
Passive Solar Space Heating and Cooling	Sunrooms (Isolated gain)	Any	New
Passive Solar Space Heating and Cooling	Thermal Chimney	Any	New
Passive Solar Space Heating and Cooling	Trombe Walls (Indirect gain)	Any	New
Passive Solar Water Heating	ICS systems or Batch Systems	Residential	Retrofit
Passive Solar Water Heating	ICS systems or Batch Systems	Residential	New
Passive Solar Water Heating	Thermosyphon Systems	Residential	Retrofit
Passive Solar Water Heating	Thermosyphon Systems	Residential	New
Solar Electricity Generation	Building Integrated PV Grid Intertie	Any	Retrofit
Solar Electricity Generation	Building Integrated PV Grid Intertie	Any	New
Solar Electricity Generation	Photovoltaic (PV) Grid Intertie	Any	Retrofit
Solar Electricity Generation	Photovoltaic (PV) Grid Intertie	Any	New
Solar Electricity Generation	Photovoltaic (PV) Off Grid	Any	Retrofit
Solar Electricity Generation	Photovoltaic (PV) Off Grid	Any	New

* Sunrooms are considered to have a low degree of technical difficulty for new construction, but a medium for retrofit, due to space considerations.

Included in this preliminary alternative screening to evaluate the items in the table above was a ranking system that included the items listed below:

- Capital Cost ($5,000 or less = 5 points, $5,001 to $10,000 = 3 pts, and greater than $10,000 = 1 point)
- O&M per year ($250 or less = 5 points, $251 to $500 per year = 3 points, and greater than $500 = 1 point)
- Energy Savings (High [more than 20%] = 5 points, Medium [11-20%] = 3 points, and Low [0-10%] = 1 point)
- Technical Difficulty (Low = 5 points, Medium = 3 points, and High = 12 point)

Of this extensive list fifteen (15) site-specific alternatives were evaluated in detail; eleven (11) for the Helmick Road Reservation and four (4) for the Bow Hill Complex. All but one of these alternatives showed at least a 3 percent rate of return on investment, and all would result in significant reductions in emissions of greenhouse gases by replacing conventional energy sources. A few of the alternatives were a couple of options that served the same purpose. These would be further evaluated in the Strategic Energy Plan.

The Helmick Road Reservation site retrofit Renewable Energy Resource Projects included Photovoltaic Systems for the rental units, the Tribal Complex, and two of the

community buildings; Solar Water Heating System for the rental units and the Tribal Complex; and Geothermal Heat Pump Systems for the rental units and the Tribal Complex. These same projects are ideal for new construction also.

The Bow Hill Complex site Renewable Energy Resource Projects included Geothermal Heat Pump Systems (either Horizontal Ground Loop Array or Vertical Ground Loop Array) and Combined Heat and Power Systems for Existing Conditions and Future Expansions.

Strategic Energy Plan

After the Energy Efficiency Improvement Projects Assessment and the Renewable Energy Resource Assessment were complete, the projects were further evaluated with the departments associated with the building projects to their input. The projects with a couple of options were further evaluated with a preferred option chosen. This list and the list of concerns and comments from the departments were reviewed by management. All comments were incorporated into the Strategic Energy Plan. Within the Strategic Energy Plan these items were prioritized and incorporated into an Action Plan.

The Action Plan is divided into Energy Efficiency Projects and Renewable Energy Projects. The Energy Efficiency Projects are listed as projects to complete (dependant upon available funding sources), "Within the First 3 Years", "Within 3 to 6 Years", and "At the Time of System Replacement". The Renewable Energy Projects are listed as projects to complete (dependant upon available funding sources), "Within the First 5 Years", "Within 5 to 10 Years", and "Long-Term".

Many of the Energy Efficiency Projects at the Helmick Road Reservation have been completed as stated in the Conclusions - Energy Efficiency Improvement Projects Assessment section of this report. The Tribe continues to seek funding to complete these projects.

Energy Conservation Code

Through the long process of developing the Strategic Energy Plan, it was brought to our attention many times that a Development Code was needed with a section specifically for an Energy Conservation Code to insure good planning, engineering, and construction to develop energy efficiency in new development; that incorporating energy efficiency designing and materials create energy efficient buildings and infrastructure with low or no O&M and less need for larger energy efficient equipment.

With the grace of the DOE, remaining grant funds were used to complete a Draft Energy Conservation Code. Other funds were and are being used to complete the Development Code.

The Energy Conservation Code includes sections for Energy Efficiency, Renewable Energy (Site and Building Development), Residential Energy Efficiency, Community Energy Efficiency, and Energy Inspections. Residential and Community Energy Efficiency sections include building envelope, mechanical systems and equipment, service water heating, indoor and outdoor lighting.

RECOMMENDATIONS

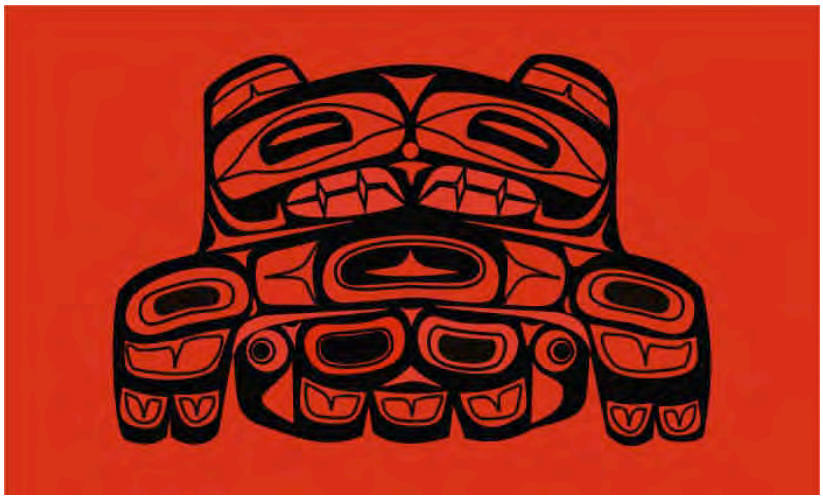
The initial work of figuring out how to plan the process of developing the Strategic Energy Plan with the consultant was a lot of work and time consuming but it was worth it. The steps of completing small reports (i.e. the Energy Efficiency Improvement Projects Assessment reports then the Renewable Energy Resource Assessment reports) and discussing each one in detail before the next report was produced helped to develop a more detailed and personalized report and stopped any process of "rubber stamping" information into our Strategic Energy Plan.

This process of developing the Strategic Energy Plan also supported any cultural, economic, or timing issues that if not brought up in a timely matter may have eventually affected the ability of the Strategic Energy Plan to be followed.

LESSONS LEARNED

Regardless of the amount of work put into the plan, the natural resources' of the Tribal Lands don't change, but the quality of the resources can be affected, and it will require implementation of the Plan as a living guidance to achieve planned targets.

Upper Skagit Indian Tribe
Energy Efficiency Improvement Project:
Helmick Road Reservation



Prepared for the

Upper Skagit Indian Tribe

UPPER SKAGIT INDIAN TRIBE

ENERGY EFFICIENCY IMPROVEMENT PROJECT: HELMICK ROAD RESERVATION

Prepared for the

Upper Skagit Indian Tribe

Prepared by

RIDOLFI Inc.

August 2006

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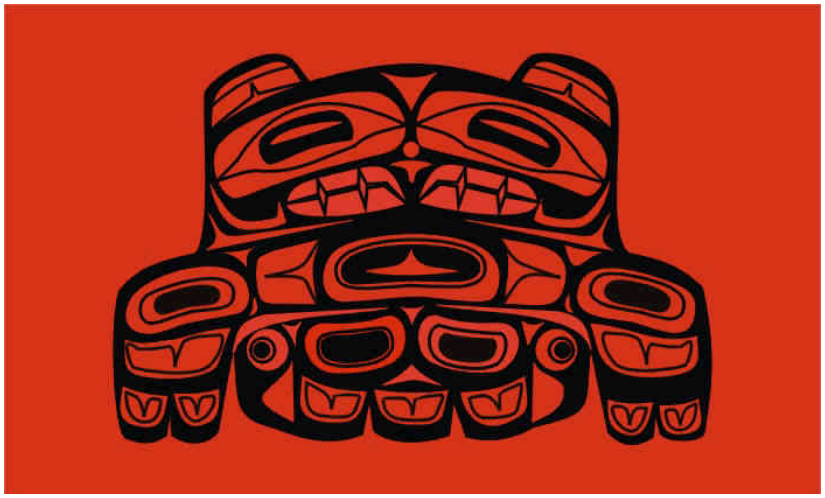
All substantive portions of the report may be reviewed on site at the Upper Skagit Tribal Offices

UPPER SKAGIT INDIAN TRIBE

ENERGY EFFICIENCY IMPROVEMENT PROJECT:

BOW HILL COMPLEX



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ENERGY EFFICIENCY IMPROVEMENT PROJECT: BOW HILL COMPLEX

Prepared for the

Upper Skagit Indian Tribe

Prepared by

RIDOLFI Inc.

January 19, 2007

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GLOSSARY OF TERMS

Annual Fuel Utilization Efficiency: The ratio of the amount of heat actually delivered to your building compared to the amount of fuel that is supplied to the furnace; a furnace that has an 80% AFUE rating converts 80% of the fuel that you supply to heat, the other 20% is lost to the environment (in flue gas).

British Thermal Unit (Btu): Basic unit of heat energy; the amount of heat necessary to raise a pound of water a degree Fahrenheit.

Kilowatt-hours (kWh): Unit of energy (usually electrical energy); 1000 watts running for one hour.

Packaged Terminal Air Conditioner: An air conditioner or heat pump that is contained in a single housing. Sometimes referred to as a "through-wall" unit.

Roof Top Unit (RTU): A packaged air conditioner or heat pump system mounted on a rooftop.

Seasonal Energy Efficiency Ratio (SEER): The ratio of the total cooling capacity in Btu during a normal annual usage period to the total electric input in watt-hours to the air conditioner or heat pump during the same period.

Split System: An air conditioner or heat pump consisting of two or more major components which are not enclosed in one cabinet; for a split system, a compressor and condenser are generally installed outside the building and the cooling coil is generally installed within the building.

Therm: Unit of heat energy equal to 100,000 Btu.

Watt (W): Unit of power (usually electrical power); 1 watt = 3.412 Btu/second.

LIST OF ABBREVIATIONS

AFUE	Annual Fuel Utilization Efficiency
ASHRAE	American Society of Heating, Refrigeration and Air Conditioning Engineers, Inc.
CFL	Compact Fluorescent Lamp
CPU	Central Processing Unit
EERE	U.S. Department of Energy, Energy Efficiency and Renewable Energy Program
EUI	Energy Use Index
HVAC	Heating, Ventilation and Air Conditioning
LCD	Liquid Crystal Display
PC	Personal Computer
PIR	Passive Infrared
PTAC	Packaged Terminal Air Conditioners
RTU	Roof Top Unit

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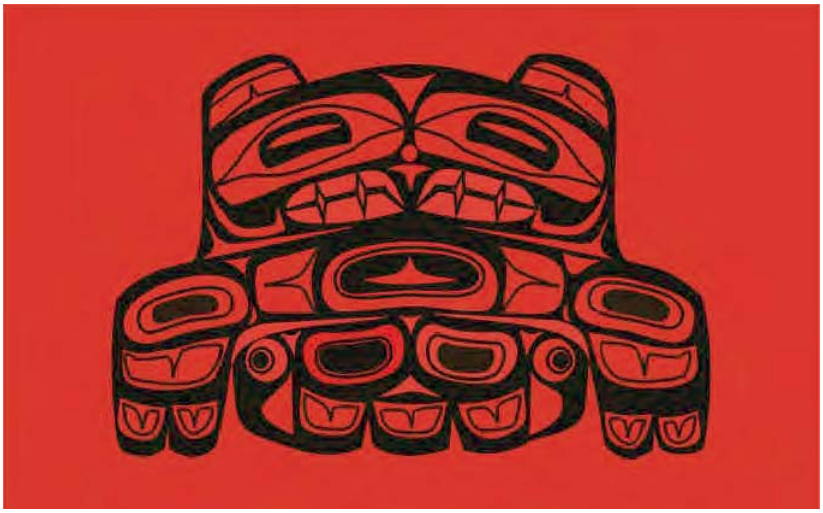
UPPER SKAGIT INDIAN TRIBE

RENEWABLE ENERGY RESOURCE ASSESSMENT



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UPPER SKAGIT INDIAN TRIBE

UPPER SKAGIT INDIAN TRIBE

RENEWABLE ENERGY RESOURCE ASSESSMENT

Prepared for the

Upper Skagit Indian Tribe

Prepared by

RIDOLFI Inc.

March 2007

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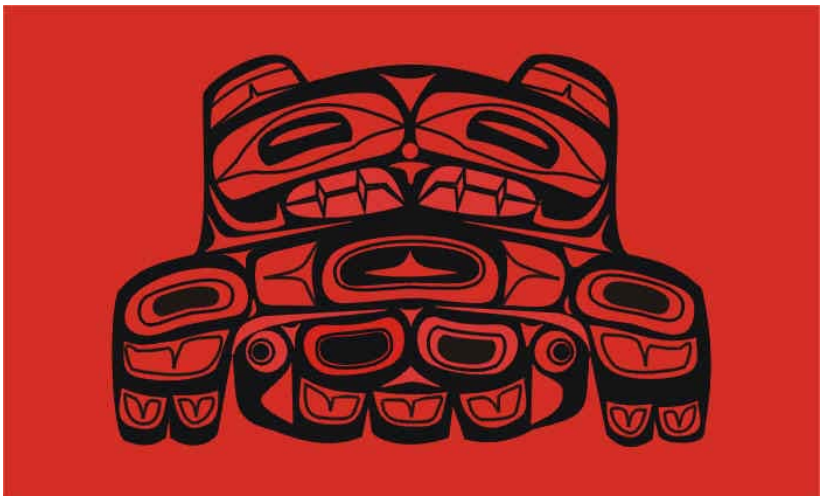
UPPER SKAGIT INDIAN TRIBE
STRATEGIC ENERGY PLAN



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STRATEGIC ENERGY PLAN

Prepared for the

Upper Skagit Indian Tribe

Prepared by

RIDOLFI Inc.

and the

Upper Skagit Indian Tribe

July 2007

EXECUTIVE SUMMARY

The Upper Skagit Indian Tribe (the Tribe) contracted with RIDOLFI Inc. (Ridolfi) to provide strategic energy planning services in support of the Tribe's efforts to develop a Strategic Energy Plan for new and existing lands at the Helmick Road Reservation and at the Bow Hill Complex, both located in Skagit County, Washington. This plan incorporates findings from the previously generated Energy Efficiency Improvement Project and Renewable Energy Resource Assessment reports for both the Helmick Road Reservation and the Bow Hill Complex:

- Section 1 of the Strategic Energy Plan describes the scope of the Plan and describes the work previously completed in support of the Tribe's energy planning efforts.

- Section 2 describes the energy vision and goals for the Tribe, including Green Power and Carbon Credits.

- Section 3 provides the summary of the energy baseline assessment for both Helmick Road Reservation and the Bow Hill Complex. This assessment describes energy sources, energy use and costs, the environmental impacts, a resources assessment, and alternatives screening.

- Section 4 is the **Action Plan** that prioritizes and phases the implementation of energy efficiency and renewable energy generation projects originally defined in the Energy Efficiency Improvement Project and Renewable Energy Resource Assessment reports. This section also addresses potential future development projects.

- Section 5 concludes the report with a summary of the estimated annual greenhouse emission reduction targets and the capital costs that would be offset by energy savings by the phased implementation of the recommended actions defined in the **Action Plan** for both the Helmick Road Reservation and the Bow Hill Complex.

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Upper Skagit Indian Tribe

Draft

Energy Conservation Code

September 2007

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