Implementation Plan

FOREST SEQUESTRATION + CARBON OFFSET PROPOSAL

Team II: Vik Bakshi, Renzo Guinto, Caroline Lauer, Michael Haggerty, Mike Maruca, Yuan Zhang

Climate Solutions Living Lab

May 8, 2017

This Report and Implementation Plan are student work product completed to fulfill requirements of the Climate Solutions Living Lab, a 12-week course offered at Harvard Law School. This report and plan were researched and written under tight time constraints to answer specific questions posed to the students in their course assignment. Any opinions expressed in the report are those of the students and not of Harvard University or Harvard Law School. If you would like to learn more about Harvard Law School's Climate Solutions Living Lab, please contact Professor Wendy Jacobs at wjacobs@law.harvard.edu.

Table of Contents

i. Acknowledgements 5

ii. Executive Summary 7

I. Implementation Plan 9

II. Feasibility Analysis 65

Option 1: Whole Village Efficiency

Option 2: Forest Management Sequestration

Option 3: Renewable Energy Project

III. Screening Exercise 139

ABOVE: The project team at the BP Energy Center

“The innovation is here,” Mike Maruca said. “All that we are looking into is a way an outside player that might want to capitalize on carbon credits might be able to fill a gap or make something happen that wouldn’t otherwise occur.”

QUOTED ON “ALASKA’S ENERGY DESK”
ALASKA PUBLIC MEDIA (3/14/17)

i. Acknowledgements

MAY 8, 2017

We would first like to thank Professor Wendy Jacobs, the Emmett Clinical Professor of Environmental Law at Harvard Law School. Professor Jacobs made this project possible through her organization and management of the Climate Solutions Living Lab course. This project is a testament to her consistent and tireless efforts over the entire academic year. We thank her for providing vital resources and support, providing us with the tools necessary to confront this exciting, multi-disciplinary challenge, as well as arranging for us to meet with a wide range of experts and practitioners.

We would also like to thank the rest of the teaching staff, including Jonathan Buonocore, Drew Michanowicz, and Memo Cedeno. Debra Stump, the Teaching Assistant for our team, provided us with key insights, feedback, and reports, and helped to connect us with professionals in southwest Alaska. The Harvard Office for Sustainability provided the financial support that allowed us to travel to Anchorage, Alaska, giving us the space and time to grow as a team and hone in on potential projects.

Special thanks as well to Bruce Wright, who was a wonderful host to our team in Anchorage and answered every question we came up with. Thank you as well to Brian Hirsch, Chris Rose, and Mead Treadwell for meeting at length with our team members and introducing us to the Alaska energy ecosystem. Josie Hickel and David Phillips of the Chugach Alaska Corporation, as well as Rand Hagenstein of the Nature Conservancy, provided their time and insight and allowed for a deeper analysis of the forest carbon project than would otherwise have been possible.

Lastly, we would like to thank all the participants and leaders at the SWAMC and Energy Finance meetings in Anchorage in February 2017, including Laura Vaught from SWAMC, Jed Drolet from the Alaska Energy Authority, Timothy Leach from the Alaska Housing Finance Corporation, Givey Kochanowski from the Department of Energy, and Clay Koplin of Cordova Electric. Thank you for being open and responsive to our searching questions and teaching us that the rural Alaskan energy space is rich with creative, resourceful, and dedicated people.

ii. Executive Summary

MAY 8, 2017

Our team selected and evaluated potential carbon offset projects in Alaska that could achieve 50,000 metric tons of credible and legitimate CO2 equivalent emission reduction credits. Some actors, including universities and for-profit entities, can use such credits to voluntarily reduce their carbon footprints. Since they are not legally obligated to do so, for the purposes of this report, they are termed "unregulated entities."

The goal of this report is to research and develop Alaska-based projects in which a regulated or unregulated entity could participate and that would maximize the emission offsets, minimize costs, and generate public health, educational, environmental, cultural, and economic development co-benefits for rural Native communities.

After an initial screening process, the results of which are included in this report, our student team narrowed the project options to three potential candidates: a hydroelectricity project, a village weatherization project, and a forest sequestration agreement on Native Corporation land. Following a feasibility analysis of these three options, we selected the "Forest Sequestration +" project and created an implementation plan.

The proposed project has two components: 1) a forest carbon sequestration project through Improved Forest Management (IFM) in the Kodiak Island region of Alaska; and 2) a Social Impact Fund for weatherization or other improvements to nearby local Native villages. Forest carbon sequestration uses IFM, such as planting, thinning, and other techniques, to increase carbon stocks within forests and reduce greenhouse gas emissions from forestry activities when compared to business-as-usual forestry practices. The IFM project will produce all the carbon offset credits, while the Social Impact Fund will generate co-benefits, in particular, public health benefits for local communities. The unregulated entity will contract with both a forest sequestration project manager, who will lay the foundation for the project, and an Alaska Native Village Corporation, who will own the land on which the project is developed.

This report will first introduce the background and goal of the project. It will then present our final Implementation Plan. The plan is followed by the Feasibility Analysis and Screening Exercise that led to the final proposal. Financing and costs, the additionality risks, the health and other co-benefits, and the relevant laws and contracting issues are addressed at each stage of screening, feasibility, and implementation.

I. Implementation Plan

Project Summary

GOALS AND BACKGROUND

PROJECT GOALS

The Intergovernmental Panel on Climate Change (IPCC) has determined that the science behind global warming is unequivocal. The IPCC further found that anthropogenic emissions of greenhouse gasses, including CO2, is "extremely likely" to be the primary cause of the observed warming, which has impacted human and natural systems around the world. Although continued emissions will "increas[e] the likelihood of severe, pervasive, and irreversible impacts for people and ecosystems," substantial reductions in greenhouse gas emissions would help address climate change risks.[1]

Federal, state, and local governments have formulated and implemented a broad variety of policies in the effort to limit emissions, including the regulation of major sources of greenhouse gas emissions, such as power plants. Unregulated entities, such as major corporations and universities, have also made public commitments to voluntarily reduce their emissions. After implementing policies to reduce their carbon footprint within their existing properties and facilities, many unregulated entities have begun looking outward to reduce emissions off-site. "Unregulated entities" seeking to reduce their carbon footprint are the primary audience for this implementation proposal.[2]

This proposal is the result of an intensive course for graduate students, enrolled in a variety of Harvard graduate programs, led by Professor Wendy Jacobs, Director of the Emmett Environmental Law and Policy Clinic at Harvard Law School. Our interdisciplinary team focused on reducing an unregulated entity's climate impacts via an emissions reduction project in Alaska, with a goal of credibly and legitimately obtaining 50,000 metric tons of CO2 emissions offsets annually.[3] We sought projects that would maximize the emissions offsets that an unregulated entity could claim, minimize costs, and generate co-benefits for rural Alaskan Native communities, including educational, environmental, cultural, and economic development benefits as well as, most especially, public health benefits.

In short, our goal is to provide an unregulated entity with a road map for a project that not only reduces CO2 emissions, but also benefits local communities in rural Alaska, some of the most underserved populations in the United States.

SELECTED OPTION

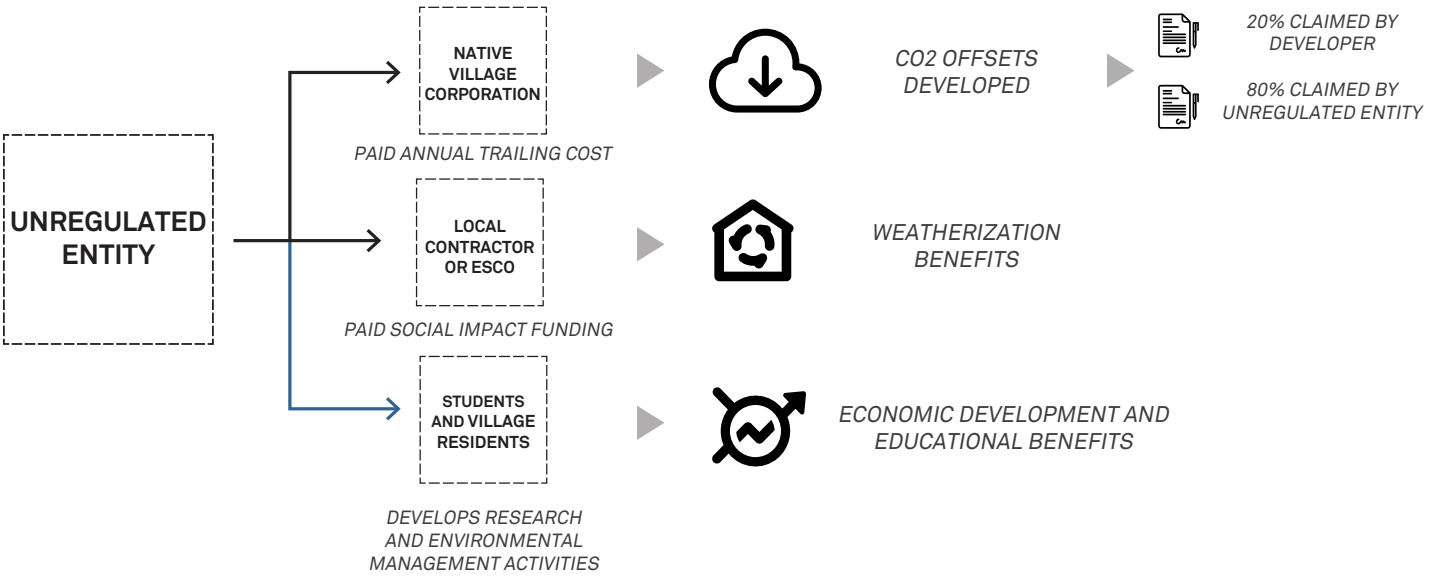
Our team considered a wide range of projects, including renewable energy generation, energy efficiency, weatherization, heating, and carbon sequestration. Many projects were discarded following an initial screening process, before our team selected three

1 IPCC, 2014: Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)]. IPCC, Geneva, Switzerland, 151 pp.

2 Language borrowed from Byers, Conleigh, Justin Galle, Jiahua Guo, Richie Schwartz, and Augusta Williams, Team IV Feasibility Report Draft, Climate Solutions Living Lab, March 2017.

3 Offsets are reductions in emissions in one place that can be used to compensate for emissions elsewhere, and are usually denominated in metric tons. Administrator. "Emissions Offsets." LEED Certification - Leonardo Academy - The Sustainability Experts®. Leonardo Academy, n.d. Web. 29 Mar. 2017.

FIGURE 1.1: PROJECT SCHEMA



higher potential ideas to examine in more depth. Those three projects, included in this report, were the subject of a feasibility study: 1) whole village energy efficiency, 2) forest carbon sequestration, and 3) renewable energy projects in Alaska. An unregulated entity could reasonably pursue any of these three options, depending on its considerations of mission alignment and willingness to pay.

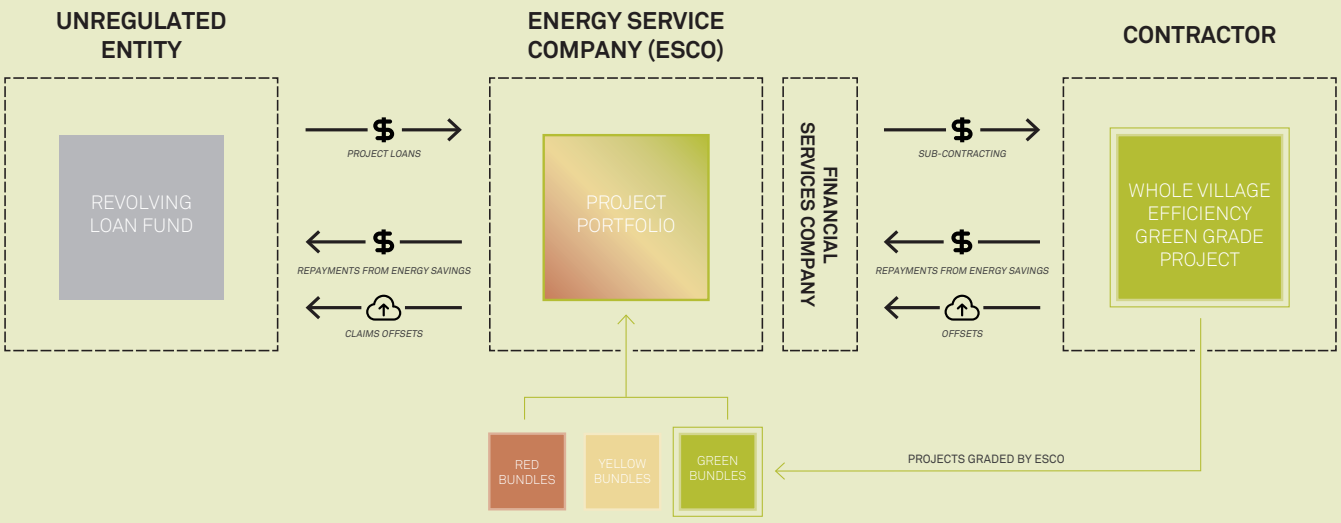
For example, a large insulation company might be drawn to the energy efficiency project, while a university that values educational co-benefits should compare those benefits across the projects. We determined that the most promising and innovative project is forest sequestration combined with weatherization. This project will minimize costs, ensure high-quality offsets at scale, and provide significant environmental and health co-benefits. The combination allows for both achieving offsets at scale and addresses social equity concerns, generating more co-benefits than forest sequestration alone.

An unregulated entity could claim offsets by entering into an agreement with a forest carbon project developer and an Alaska Native Corporation. In this arrangement, a carbon project developer coordinates and executes improved management of an allocated acreage of forest, owned by the Native Corporation. This improved forest management (IFM) ensures that carbon is sequestered from the atmosphere through natural biological processes rather than lost as carbon dioxide; essentially, IFM improves the ability of the forest's biomass to act as a carbon sink.

The forest carbon developer receives a percentage of the offsets generated and the Native corporation

BOX 1.1

Option 1: Whole Village Weatherization



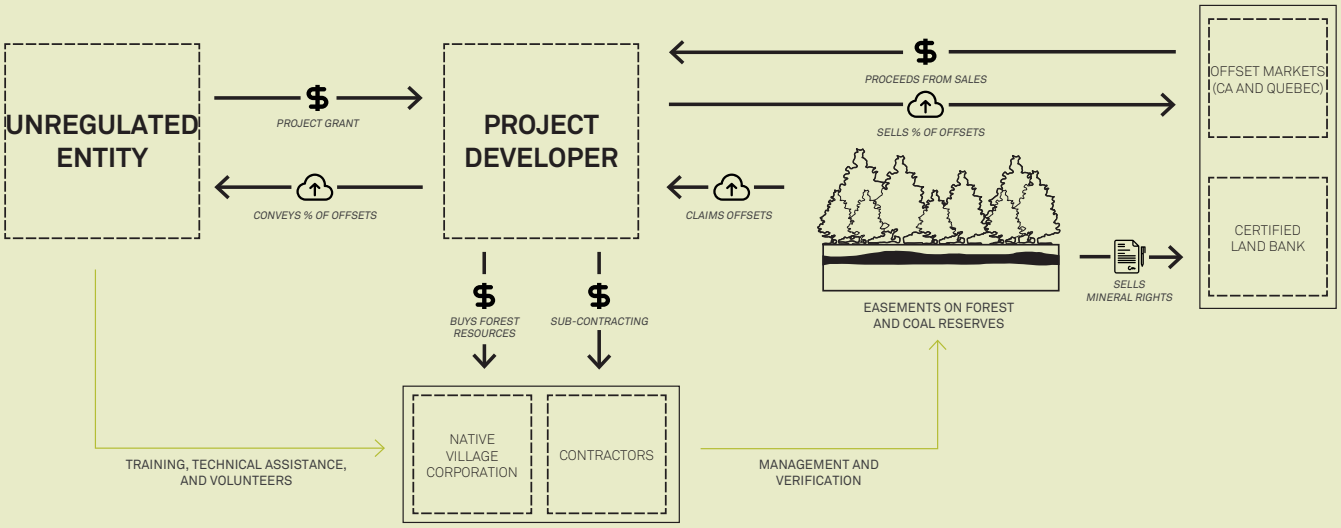
In this project, an unregulated entity partners with an energy service company (ESCO) to work with contractors in Alaskan villages to complete whole village energy efficiency projects. The potential projects would be graded green, yellow, or red depending on criteria such as existing feasibility studies, capacity of local government, the number of projects that can be bundled, and so on. Once the pipeline of projects had been evaluated and bundled appropriately, the unregulated entity would decide which projects to invest in and claim offsets as projects are completed.

receives payment for the remainder of the offsets. The developer, following several years of skills training with local residents, hands over management of the forestry project to the Native corporation. The unregulated entity pays an Alaskan ESCO or contractor to perform weatherization and other village efficiency measures. The unregulated entity and Native corporation should arrange for a process that vets proposed upgrades, complies with best practices for working with Native groups, and allows for the unregulated entity to measure the benefits.

If the upgrades result in measurable offsets, the unregulated entity should contract for the right to claim those future offsets. The unregulated entity could opt to cooperate on the ground with the contractor or ESCO or in the forest carbon project management itself. Additional players, such as a certified land bank, might be necessary depending on property ownership. Figure 1.1 illustrates our selected option.

BOX 1.2

Option 2: Forest Sequestration



Regional and village corporations are for-profit entities that serve as vehicles for distributing the settlement from the Alaska Native Claims Settlement Act (ANSCA) to eligible native shareholders. Native corporations may provide benefits that promote the health, education, or welfare of shareholders and other Alaska natives through utilization of the land they possess, and many corporations indicate that subsistence use is their primary or highest-priority use of the land.

Some Native corporations have decided that forest carbon projects provide an opportunity to ensure continuing subsistence use of the land.

An unregulated entity should arrange with a carbon project developer and a Native Village Corporation partner partner to set aside lands for improved forest management, which would capture and sequester carbon that would otherwise be released into the atmosphere as carbon dioxide.

SELECTION PROCESS

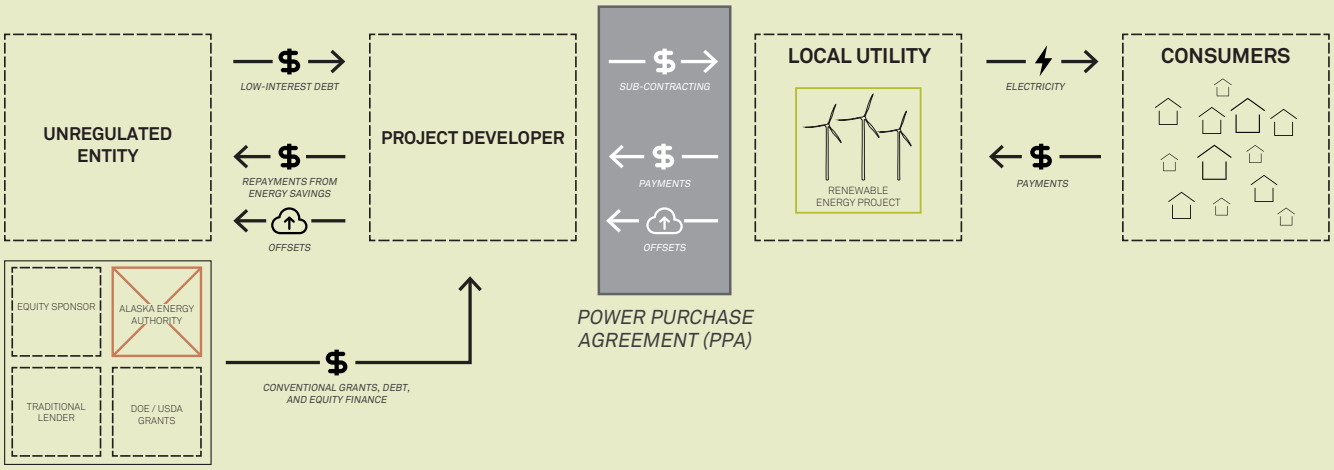
Our team initially considered project ideas based upon a variety of readings, reports, submitted project proposals, and historical findings.

Most of these resources focused on the southern and western Alaskan regions. We initially screened a list of about a dozen potential projects, and discarded most of the options on the basis of absolute barriers to implementation, such as prohibitive cost, technological uncertainty, or additionality issues.

We narrowed our possibilities down to the three with the highest potential of meeting our goal:

BOX 1.3

Option 3: Renewable Energy Project



Renewable energy projects face significant financial challenges and are often not financially viable for traditional renewable energy capital providers such as banks, equity investors, project developers, and tax equity sponsors.

This is particularly true in Alaska, where state grants previously funded the most viable projects. The difficulty of engaging traditional capital providers and the decrease in state and federal grants provides an opportunity for an unregulated entity to sponsor a renewable energy project in exchange for carbon offset credits. The unregulated entity can provide financing for the project, either as grant funding or debt financing. Regardless, the unregulated entity will partner with the project developer and local entity to see the project through to completion, and it will claim the carbon offsets once they are produced.

1. **Whole village efficiency**
2. **A forest sequestration project**
3. **Renewable energy generation**

We conducted a feasibility analysis on those three options, employing fifteen discrete criteria and using additional research and engaging in extensive, in-person interviews with Alaskan stakeholders and experts, such as utility managers, town mayors, federal and state regulators, and academics.[4] Schemata and brief descriptions of the three options and a summary

4 See the attached Feasibility Report: Carbon Offset Possibilities in Rural Alaskan Communities for further information.

of the results are above in Boxes 1.1 to 1.3.

An unregulated entity may implement any of the three projects that were analyzed; in fact, different options might be more appealing depending on the nature, mission, priorities, and resources of the unregulated entity, i.e. a non-profit institution versus a multinational corporation. However, when weighing project options, an unregulated entity should consider the tension between the potential efficacy of emissions reductions and distributional equity of potential benefits.

For example, while a whole village energy efficiency program would generate meaningful health and socioeconomic benefits to rural, underserved Alaskan communities, the project requires scaling up over many communities at a much higher cost to accomplish the goal of 50,000 tons of offsets per year. In contrast, the forest sequestration project uses an established and proven mechanism for securing credible and legitimate offsets at the required scale. However, at least within the limits of our study, we found that the forest sequestration project generated fewer co-benefits.

We ultimately selected this project because it offered a clear, economically efficient way to reach the project goal and for an unregulated entity to legitimately and credibly claim the carbon offsets. Beyond that, it is readily implementable for an unregulated entity hoping to specifically work with Alaskan communities on a carbon offset project.

In order to increase the co-benefits of the project, we propose a mechanism to finance weatherization projects for the partner Native corporation. If those weatherization projects result in carbon offsets, the unregulated entity may contract for the right to claim them. For the scope of this study, carbon offsets generated from the weatherization project are not considered.

Feasibility Analysis Summary Matrix

FEASIBILITY STUDY

	CRITERIA	PROJECT OPTIONS: WHOLE VILLAGE EFFICIENCY	FOREST SEQUESTRATION	RENEWABLE ENERGY PROJECT
ADDITIONALITY	TOTAL TONS OF OFFSETS	real difficulties	move ahead	some reservations
	ADDITIONALITY	real difficulties	move ahead	some reservations
	RISK OF ESTABLISHING CREDITS	real difficulties	some reservations	real difficulties
FINANCE	COSTS (UPFRONT CAPITAL; $ / OFFSET)	real difficulties	some reservations	some reservations
	SUBSIDIES	real difficulties	N/A	real difficulties
	TECHNOLOGICAL FEASIBILITY	move ahead	some reservations	some reservations
LEGAL	PROCUREMENT AND TRANSACTION COSTS	some reservations	some reservations	move ahead
	TAX INCENTIVES, CREDITS, LOANS	real difficulties	some reservations	some reservations
	CONTRACT ISSUES	some reservations	some reservations	some reservations
POLICY	GOVERNANCE COMPLEXITY	some reservations	move ahead	some reservations
	ECONOMIC DEVELOPMENT POTENTIAL	some reservations	some reservations	some reservations
PLANNING & DESIGN	DISTRIBUTIONAL EQUITY	move ahead	real difficulties	move ahead
	SOCIAL CAPITAL	move ahead	real difficulties	move ahead
PUBLIC HEALTH	EDUCATIONAL BENEFITS	some reservations	some reservations	some reservations
	PUBLIC HEALTH BENEFITS	move ahead	some reservations	some reservations

MOVE AHEAD · SOME RESERVATIONS · REAL DIFFICULTIES · INSURMOUNTABLE BARRIERS · N/A

Implementation Plan

FOREST SEQUESTRATION +

The proposed project is carbon sequestration through improved forest management in the Kodiak Island region of Alaska, supplemented with weatherization. In essence, an unregulated entity would partner with a forest project developer and the Native village corporations that own the forests of the northeastern region of Kodiak Island. This region is appropriate because the generated carbon offsets meet the geographical criteria established by the California Air Resources Board (CARB).

CARB promulgates an extensive forest carbon protocol,[1] which details the requirements, including quantification and verification, of various forest sequestration projects. The CARB market recently partnered with the Quebec market, and other regional Canadian markets are expected to join soon as well, creating a more robust future market for offsets. The project developer would plan, survey and select a designated area, and execute Improved Forest Management (IFM) techniques to ensure that the allocated acreage maximizes sequestration of carbon dioxide from the atmosphere into the biomass, and therefore, generates credible carbon offsets.

Improved forest management, at its highest level, refers to "a suite of practices designed to reduce the negative environmental and social impacts of forestry activities while maintaining forest product supply."[2] IFM practices fall into three categories: sustainable harvesting of the forest, protection of the forest, and new growth to increase biomass. Examples of each category include improved identification of commercial trees, riparian zone buffers, and seedling establishment, respectively.[3] The unregulated entity would pay the associated Native Village corporations at a negotiated price comparable to the CARB market rate for the carbon offsets being claimed, while the project developer would be paid through a pre-determined percentage of generated carbon offsets as well.

Finally, the unregulated entity would also invest in weatherization or other improvements to the local Native villages to ensure that the co-benefits of the project, especially the public health benefits, are actually shared with the Native people in the associated region to achieve distributional equity.

Through this partnership, the Native Village corporation would receive a series of payments from the unregulated entity in exchange for the offsets. During the contracting period, the unregulated entity would negotiate the payment amounts, rates, timing, and periodicity of those payments to the Native village corporations. For example, an unregulated entity could either pay the Native Corporation for all of the offsets up-front, or negotiate to pay the Native Corporation over time at the prevailing CARB market rate.

In the selected model for this implementation plan, the unregulated entity agrees to pay the Native Corporation 50% of the offsets up-front at the current CARB market rate, and the remainder of the payments are issued as offsets are claimed and retired over a ten-year time horizon. Furthermore, the unregulated entity

1 California Environmental Protection Agency. Air Resources Board. "Compliance Offset Protocol U.S. Forest Projects." 2015.

2 Griscom, Bronson, and Rane Cortez. "The Case for Improved Forest Management (IFM) as a Priority REDD+ Strategy in the Tropics." *Tropical Conservation Science* 6, no. 3 (August 1, 2013): 409.

3 *Ibid*, 411.

also agrees to invest in the Native Alaskan community in the form of a project such as weatherization for improved energy efficiency, paid as a "Social Impact premium" above and beyond the agreed upon price of offsets. This amount would be paid directly to the project developer of the social impact project, such as an energy services company (ESCO) in the case of a weatherization project to benefit Native village residences.

In this implementation plan's model, the unregulated entity pays approximately $8 million to the Native Corporation in exchange for the rights to claim the offsets over a ten year period, and also invests $800,000 – a 10% Social Impact premium – into weatherization projects, paid directly to an ESCO.

SCOPE

For the sake of meeting the project goal – 50,000 tons of offsets for ten years – the project requires a total of approximately 18,000 acres of forest from Afognak and Raspberry Island, which is within the greater Kodiak Island chain. That number is based upon assumptions in Table 2.1 (adjustable model available in Appendix E).

Through IFM, the project will develop about 722,000 tons of carbon offsets at a rate of 40 tons/acre.[4] The project developer will claim 20% of these offsets as payments, leaving 577,500 tons of offsets for the unregulated entity to claim over a ten-year period. However, the remaining offsets may be discounted by buffers to address the risks of permanence and leakage. Permanence refers to the CARB requirement of a 100-year project. As such, the Native village

4 The 40 tons/acre offset figure was based upon the model of the Chugach Alaska Corporation's deal with New Forests, a sustainable forestry investment firm. The exact financial terms are not disclosed, but the project is expected to generate 4 to 5 million tons of offsets through IFM of 115,000 acres of forest, or approximately 40 tons per acre. More information is available in the attached Feasibility Analysis.

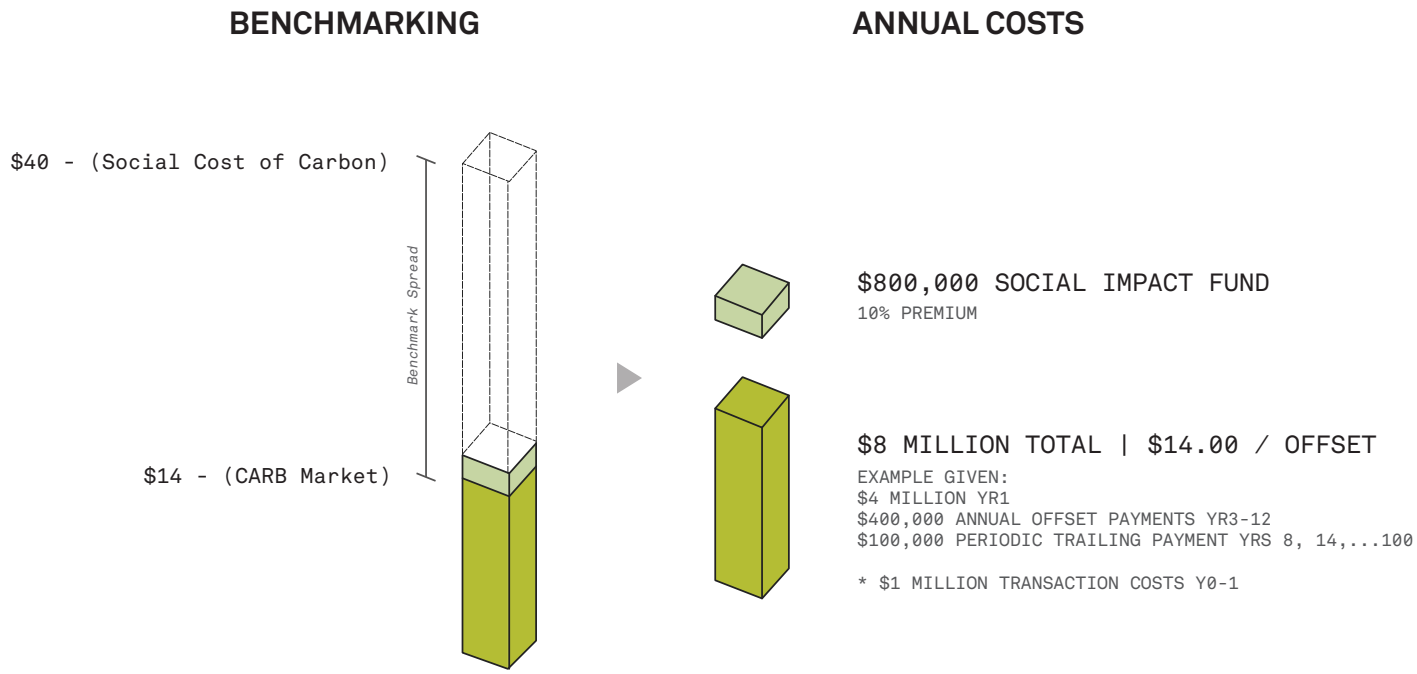
TABLE 2.1: COST ASSUMPTIONS

Key Assumptions	
Unregulated Entity Discount Rate	8.0%
Target # Offsets (annual):	50,000
Target # of Years:	10
Offset / Acre	40
Project Developer Offsets	20.0%
Buffer - Permanence Risk:	10.0%
Buffer - Leakage	5.0%
Market Price Offset	$14.00
Market Rate Offset Increase	2.5%
Social Impact Premium	10.0%

Other Project Costs	
Initial Feasibility Assessment	$25,000
Imagery Analysis	$10,000
Forest Inventory	$5,414
Biodiversity Assessment	$40,000
PDD Drafting & Follow-up	$50,000
Business Planning & Finance	$25,000
Legal/Contracting Costs	$30,000
Validation Costs	$100,000
Land Bank Transaction Fee	$100,000
Training Costs for Native Villagers	$150,000
Health Impact Assessment	$100,000

Other Project Costs	
Required # of Acres	18,047
Project Developer Offsets	144,375
Unreg. Entity Offsets (total)	577,500
Unreg Entity Offsets/Year	57,750
Effective Cost Offset ($/ton)	$9.25

FIGURE 2.1: PROJECT BENCHMARKING



corporation(s) will be trained to continue management of the forest for the life of the project after the project developer and unregulated entity have fulfilled their obligations.

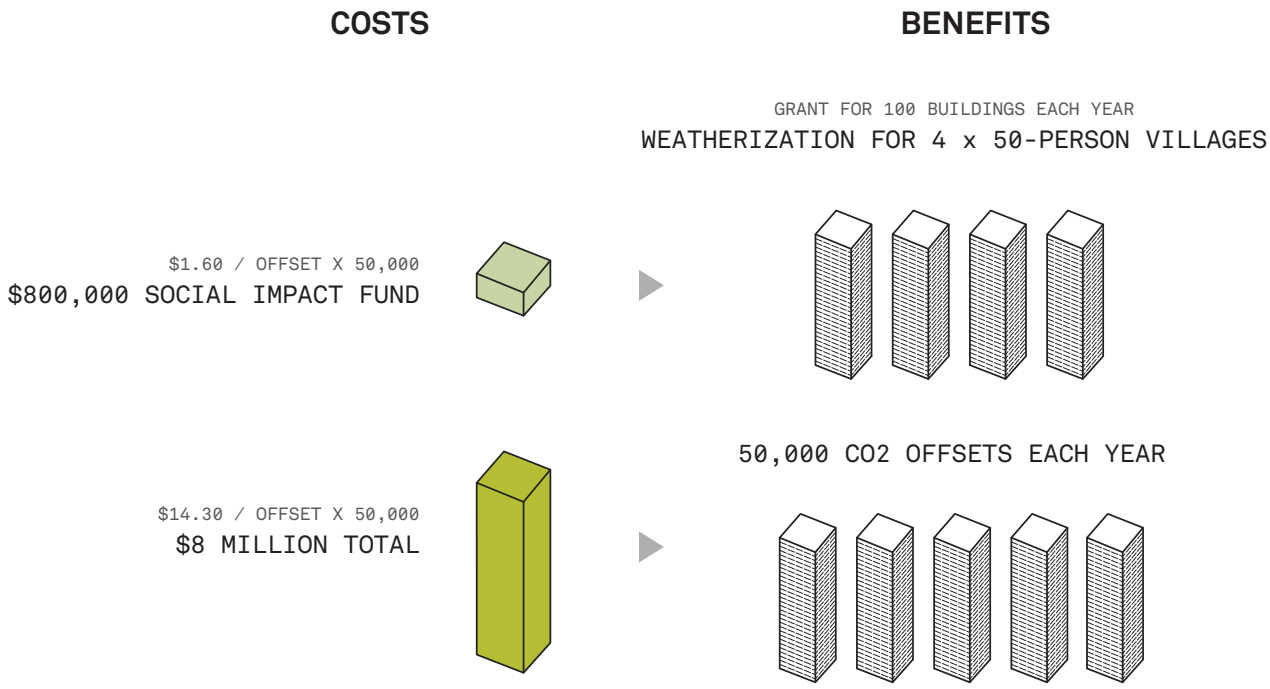
After accounting for the buffers for permanence and leakage risks, the unregulated entity will effectively claim at least 500,000 tons of offsets from the project, or 50,000 tons/year for ten years, at a rate of $12.26/ton when discounted back to the present value, as compared to an effective rate of $10.10/ton for simply purchasing the desired offsets on the CARB market. (These numbers may appear low because they are discounted for the net present value of the projects as compared to the projected market rates for carbon offsets). By doing so, the unregulated entity is effectively paying a 21% premium over the market rate for the same number of offsets, in exchange for the numerous additional benefits rather than simply "purchasing the paper" offsets in the market.

COSTS

The cost of this project can be benchmarked against various carbon alternatives. For the sake of comparison, there are two relevant benchmarks. An unregulated entity could choose to simply buy offsets from a reliable and credible market, such as the CARB carbon offset market, and retire those offsets.

At current trading prices and projected futures contracts, that price is $14/ton. In contrast, the US EPA has estimated that the Social Cost of Carbon (SCC) to

FIGURE 2.2: PROJECT COSTS & BENEFITS



be $36-40/ton.[5] Notably, Yale University specifically employed the EPA's SCC when developing their own plan to calculate and reduce their carbon footprint, and placed the SCC at $37/ton.[6] As such, an unregulated entity pursuing the Alaskan forest carbon sequestration can compare the price they pay per offset to these benchmarks.

For an 18,000-acre forest, the project's net present value at an 8% discount rate (cost) is approximately $7.4 million, as compared to simply purchasing the offsets in the market for $6.1 million. This $7.4M cost is inclusive of the project's implementation costs, health impact assessment, social impact project, up-front offset payment, recurring offset payments, and trailing costs for operations and maintenance and periodic verifications. There are several additional important considerations that should be evaluated and considered:

There are numerous transaction costs associated with this type of project:

The majority of these (e.g. forest inventory, biodiversity assessment) will be paid by the forest project developer. The project developer (e.g. a corporation such as the California-based New Forests) is

5 "The Social Cost of Carbon." EPA. Environmental Protection Agency, 09 Jan. 2017. Web. 26 Apr. 2017. <https://www.epa.gov/climatechange/social-cost-carbon>.

6 Wihbey, John. "Understanding the Social Cost of Carbon." Yale Climate Connections. Yale Center for Environmental Communication, 06 Jan. 2017. Web. 26 Apr. 2017. <https://www.yaleclimateconnections.org/2015/02/understanding-the-social-cost-of-carbon-and-connecting-it-to-our-lives/>.

TABLE 2.2: SENSITIVITY ANALYSIS

SENSITIVITY ANALYSIS				
Adjusting for the number of tons of offset / acre				
Offsets/Acre of Forest Sequestered	30	**40**	50	60
Required # of Acres	24,063	**18,047**	14,438	12,031
Effective Cost/Offset ($/Ton)	$12.26	**$12.26**	$12.26	$12.26

The tons of offsets/acre figure only effects the acreage of forest required, not the effective rate. The rate is based upon how much the Unregulated Entity pays the Native Village Corporation per ton of offsets, not on a per acre basis.

Adjusting for the "Social Impact" premium invested on top of the offset payments				
Social Impact Premium	0%	**10%**	20%	30%
Effective Cost/Offset ($/Ton)	$11.11	**$12.26**	$13.42	$14.57
% Increase in Cost of Project	10.0%	**21.4%**	32.9%	44.2%

The base comparison is the effective cost/ton of purchasing on the CARB market, which is $10.59/ton. By adding a premium for a Social Impact investment, e.g. weatherization of Native Village residences, the effective cost/ton of offsets increases. At a 10% Social Impact Premium, the Unregulated Entity is effectively paying 21.4% more per ton of offsets than by simply buying offsets on the CARB market.

Adjusting for the unregulated entity's discount rate				
Discount Rate	2%	5%	**8%**	12%
CARB only Offset Cost/Ton	$14.41	$11.98	**$10.10**	$8.22
Forest Project Offset Cost/Ton	$16.34	$13.90	**$12.26**	$10.64
% Increase in Cost of Project	13.4%	16.0%	**21.4%**	29.4%

The discount rate significantly affects the effective cost/ton of offsets. This is because in this scenario, the Unregulated Entity pays the Native Village Corporation for the offsets over time as they are claimed. Therefore, the Unregulated Entity benefits from locking in the $14.34/ton market rate in Year 2 and applying it over all years. At an 8% discount rate, the Unregulated Entity is effectively paying 21.4% more per ton of offsets than by simply buying offsets on the CARB market.

compensated for these up-front transaction and project execution costs in the form of a fee, which is equivalent to 20% of the generated carbon offsets.

Project time horizon:

The project will take nearly two years[7] of planning, surveying, and development before the unregulated

7 According to the CARB Compliance Offset Protocol, the project operator or authorized designee (project developer) may have to wait 6-24 consecutive months plus the verification period (which may take up to 13 months) before the first crediting period begins. Chapter 3.7 (c) states that "first crediting period begins on the first day of the first reporting period as identified in the first verified Offset Project Data Report received by ARB." CARB Regulation Subarticle 13 #95976 states that the initial Offset Data Report has to cover the first reporting period, and the CARB Regulation #95802 (334) states that the first reporting period may consist of 6-24 consecutive months. For report verification timeline, Chapter 8 (c) states that the Verification Statement of the initial reporting period must be received within 13 months after the conclusion of the Reporting Period. Therefore, the project operator will have to wait for 6-24 months to come up with an initial Project Data Report and then up to 13 months of verification period.

entity can credibly claim the carbon offsets. During these two years, the unregulated entity will conceivably continue to purchase carbon offsets at the CARB market rate.

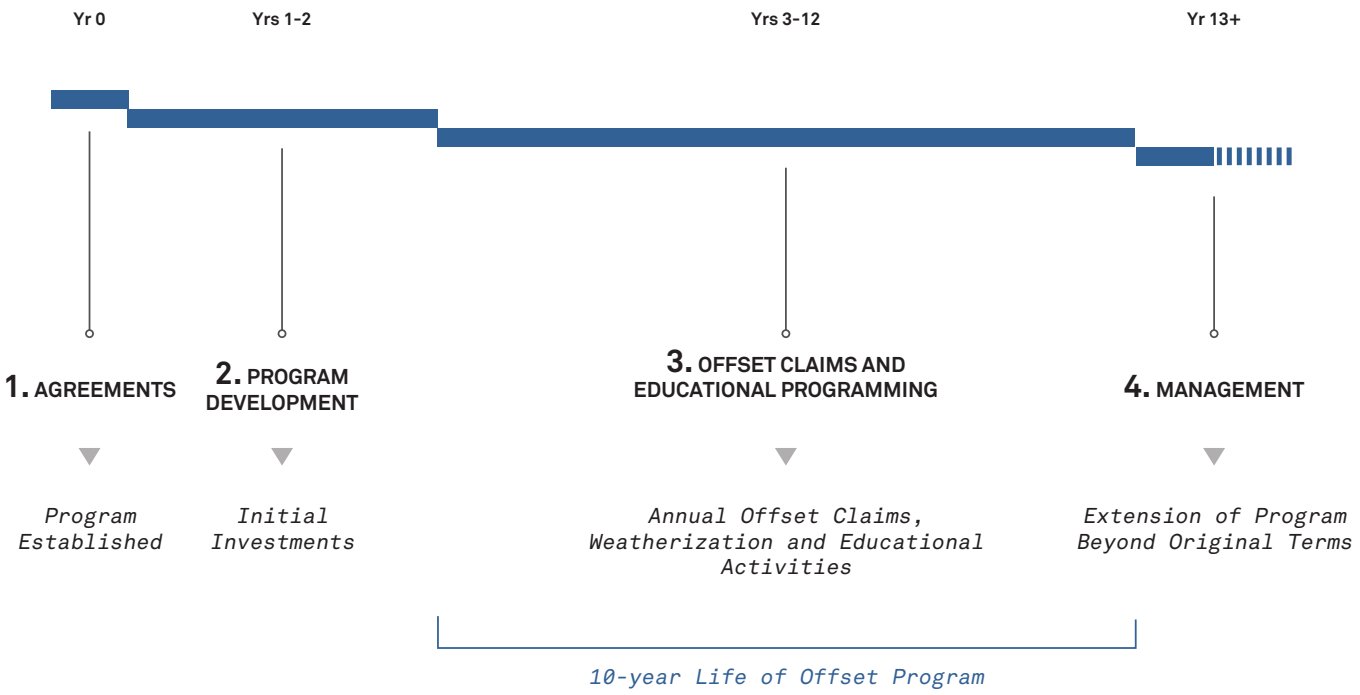
Therefore, for the unregulated entity, the project actually has a 12-year time horizon, and carbon offsets are laid out accordingly over this period of time. The alternative, simply purchasing carbon offsets from the market, is also laid out over a 12-year time horizon, to ensure a fair comparison in terms of time-value of money and discount rate.

The project's costs consist of:

- Purchasing offsets from the market during project planning/development (2 years)
- Select implementation and transaction costs (the majority of these are paid by the project developer)
- Up-front offset payment to Native Corporation (50% of the offsets' market value)
- Incremental offset payments to Native Corporation (remaining 50% of offset value)
- Health impact assessment
- Trailing costs (O&M, periodic verification audits)
- Social Impact project cost (10% of the offsets' market value in this case)

This model, based upon the assumptions in Table 2.1, is simply one example of how an unregulated entity could structure the agreement. The $12.26/ton cost is 21.4% higher than the cost of $10.10/ton for simply purchasing offsets in the market is tested for sensitivity in Table 2.2.

FIGURE 2.3: PROGRAM PHASES



BOX 2.1

About Forest Sequestration

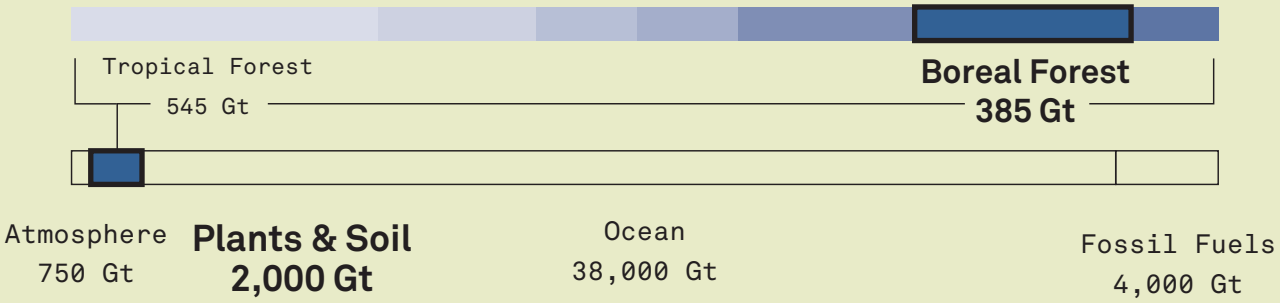
Forest sequestration programs are categoized by CARB as:

- Avoided Conversion, which means no logging is done in the sequestered area;
- Reforestation, which means the regeneration of coverted forests in order to restore their carbon sequestration capacities; and,
- Improved Forest Management, which means both selective conversion and replanting to optimize forests as carbon sinks.

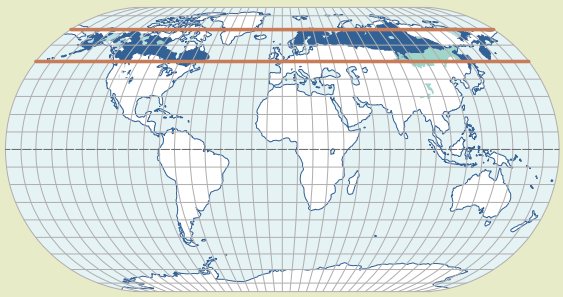
Our proposal falls within the third category of improved forest management.

The Boreal forests in Alaska play a small, but important role in the global carbon cycle, and a

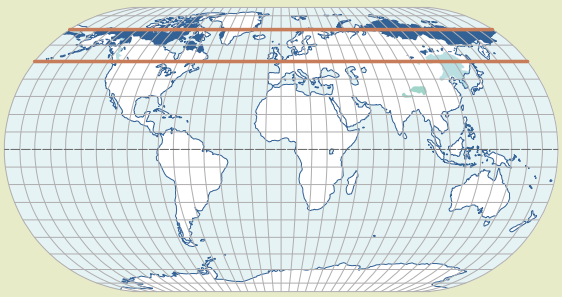
GLOBAL CARBON STOCKS[1]



1 Van Cleve, et. al, 1986; Rubel and Kottek, 2010.

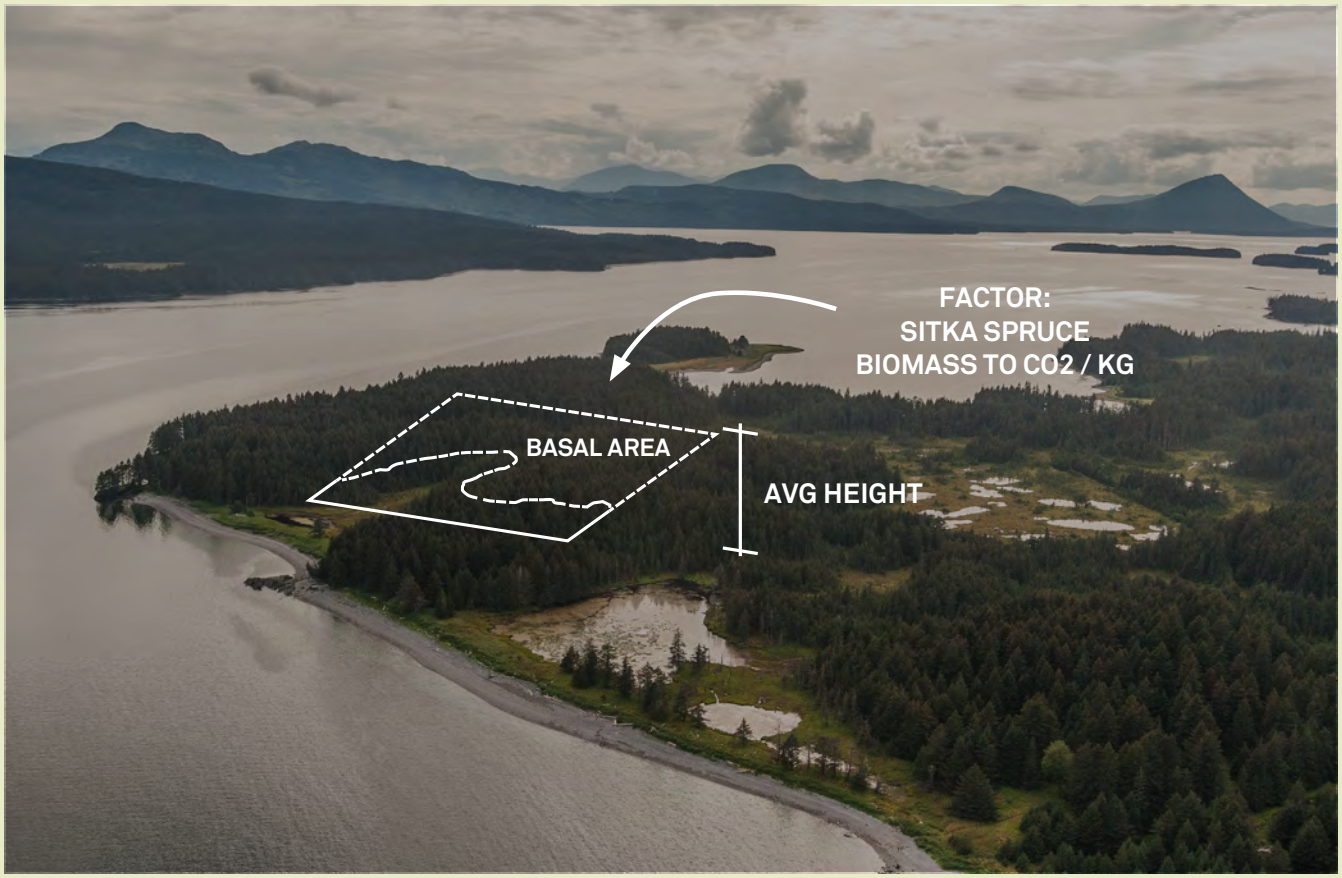


Boreal Forest in 2020



Boreal Forest in 2100

CALCULATING CARBON OFFETS

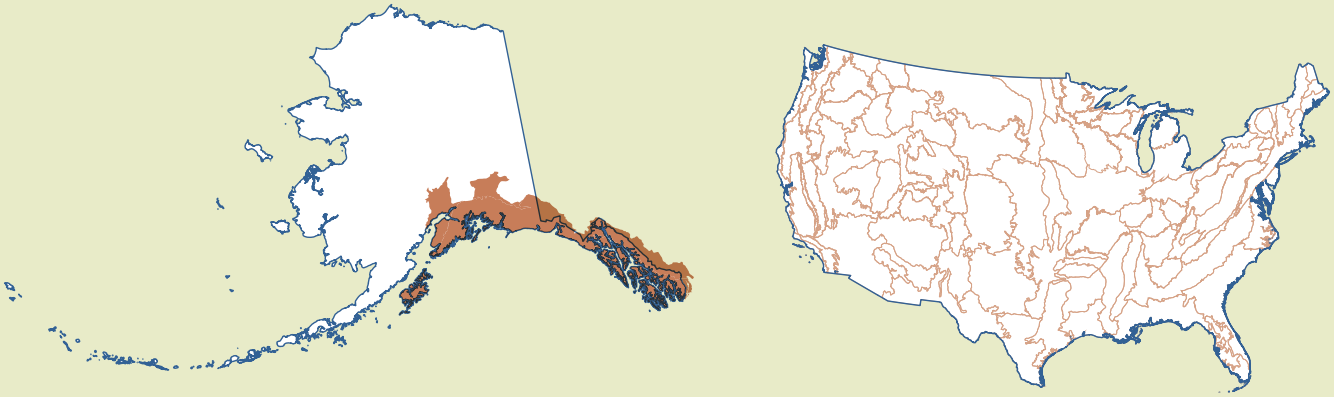


major role in the terrestrial carbon cycle. These forests, which are located in the arctic regions of North America and Siberia, contain about 385 Gt of the 2,000 Gt of sequestered terrestrial carbon. Optimizing the capacity of these forests to sequester carbon therefore represents an important strategy for addressing climate change.

The CARB protocol provides specific methods for calculating the total amount of carbon per year that an acre of forest will sequester. Generally speaking, the equations involve calculating the "basal area" (an average of total biomass – twigs, branches, leaves, and tree trunks – in a horizontal slice of the area) and the average height of trees in a given area. The product of these two yields an overall biomass volume. The CARB protocol provides species-based factors that are applied to the biomass volume in order to determine the total carbon the forest area will sequester.

Carbon sequestration offers an alternative to Alaska Native Corporations who might otherwise seek to log their lands in order to assure financial

CARB PROTOCOL ELIGIBLE SUPER SECTIONS



stability. This, in fact, recently occurred from 2010 to 2016 when the Leisnois corporation on Kodiak Island logged Sitka Spruce, causing disruption of habitat and the nuisances associated with logging. While the Alaska Native Corporations shall have the right to manage their lands at their will – which was recognized in the debates surrounding the Leisnois activity – sequestration offers them the opportunity to extract value from their forest holdings, while conserving the ecosystems within their lands.

An important precedent for our project is the Chugach Forest Sequestration Project that the Chugach Native Corporation undertook with the California-based group New Forests. Offsets created through this deal will be sold into the CARB market. This deal proves the viability of forest sequestration projects in Alaska and establishes the credibility of such projects.

Beyond carbon offsets, forest sequestion projects also create many co-benefits related to wildlife

The Leisnoi Native Corporation logged 15,000 acres in Kodiak between 2010 and 2016 due to financial distress of the corporation.

habitat maintenance, timber conversion, and improved access to natural areas:

- Subsistence economy
- Ecosystem services
- Soil restoration
- Biomass energy (alternative to diesel)
- Specialty lumber products (LVL, CLT)
- Recreation
- Scientific research
- Wildfire prevention
- Disaster recovery

BOX 2.2

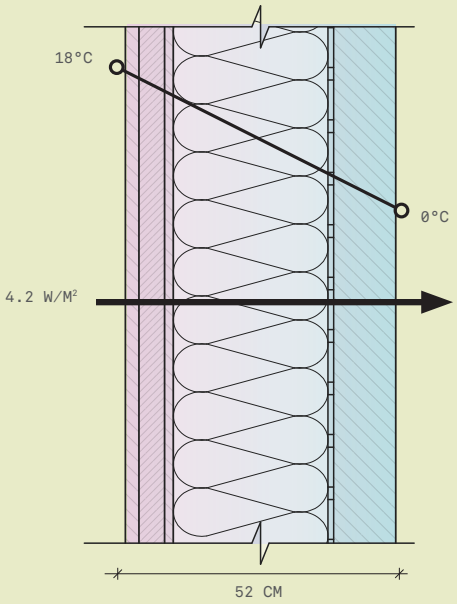
About Weatherization

In the last decade, the State of Alaska has implemented a number of home and public facility weatherization programs that aim to reduce electricity consumption in buildings and to reduce diesel fuel use for indoor heating.

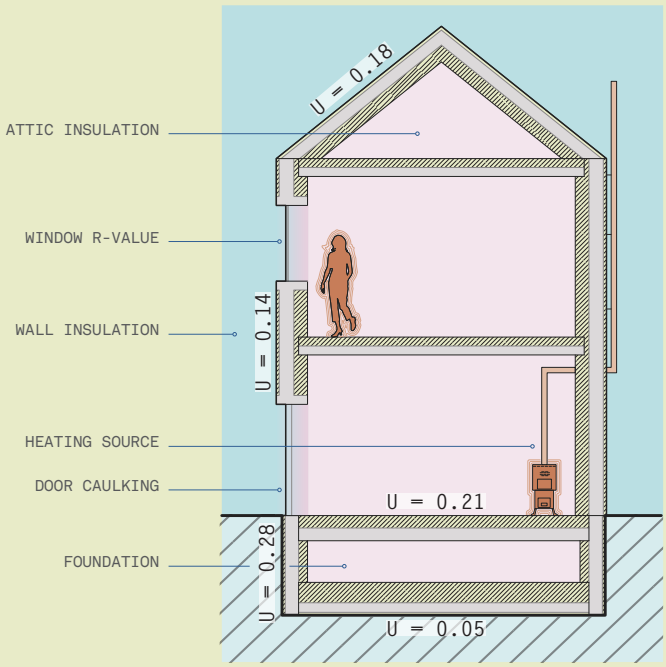
These programs include the Low-income Weatherization (Wx) program, the Home Energy Rebate (HER), RurAL CAP Energy Wise, and the Weatherization Assistance Program (WAP), which offered grants and rebates to households to weatherize from 2008 to 2016. The typical rebate for a home owner was $6,500 to $10,000.

These programs are important for reducing carbon emissions from buildings, but also for addressing the energy burden that low-income, especially rural, communities experience. In some rural areas, the proportion of household income spent on electricity and home heating is almost 50 percent. Increasing the U-value of insulation, replacing and sealing doors and windows, and replacing

HOME WEATHERIZATION DIAGRAMS

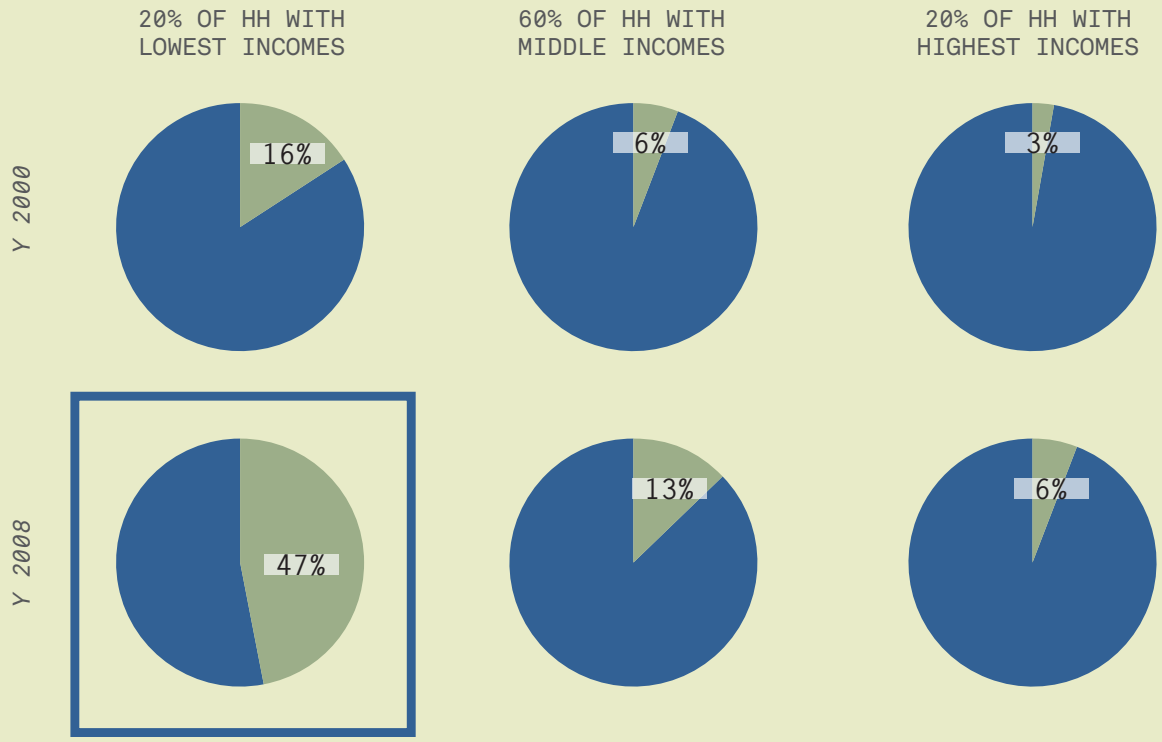


TYPICAL STACKED-WOOD WALL
U = 0.12



ASHRAE 9.1 (ZONE 8) U-VALUES AND OTHER INTERVENTIONS

% INCOME SPENT ON HOME HEATING[2]



2 Cold Climate Housing Research Center, "Small-Scale Biomass Combined Heat and Power Demonstration Project," 2012

diesel fuel heaters with electric heaters and other technologies can decrease energy costs and improve indoor air quality and thermal comfort.

However, as our team's feasibility report explains, home weatherization is not an effective program for creating a large quantity of carbon offsets. In addition, ongoing quantification and verification of offsets achieved through weatherization is difficult because of the remoteness and uniqueness of each household.

Data from the Kodiak Regional Energy Plan show that at a cost of $5,000 per home, weatherization could reduce heating expenses by a third, resulting in $1,500 annual savings per household. Moreover, weatherization would result in a reduction of 818 gallons of diesel used for heating, which converts to about 9 metric tons of carbon emissions, or 9 offsets.

However, available data vary from community to community. And the cost of weatherization per offset achieved is very high. An analysis of weatherization by the Cold Climate Housing Research Center shows that weatherization in the Aleutians costs $1,000 per offset.

CONVERSION OF WEATHERIZATION TO AVOIDED CO2[3]

EXAMPLE: RESULTS OF HOUSE DISTRICT 37 (BRISTOL BAY / ALEUTIANS) REBATE PROGRAM

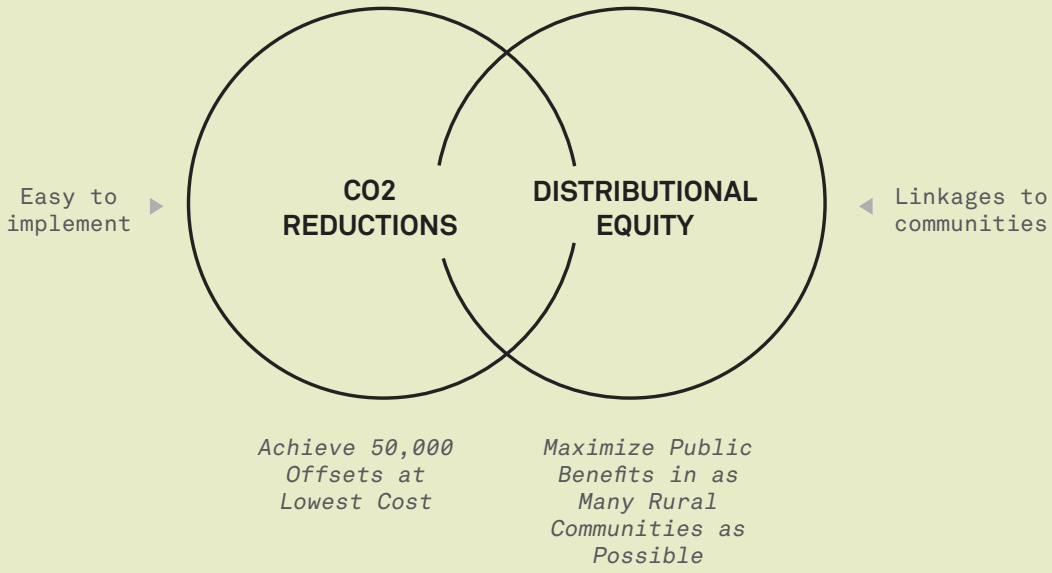
- OUT OF 98 APPLICATIONS, ONLY 40% COMPLETED
- AVERAGE HOME AGE – 28.6 YRS
- AVG. REBATE AMOUNT $5,000
- AVG. COMPLETION TIME 16.7 MONTHS
- AVG. ENERGY SAVINGS 28%
- AVG. CASH SAVINGS - $2,332

TOTAL CO2 OFFSETS

- 36 HOUSES
- 10.18 CO2 KG / GALLON X 16,979 GALLONS X 1 TONNES / 1,000 KG = 173 METRIC TONNES CO2
- **~$1,000 SPENT PER OFFSET**
- **~5 OFFSETS PER HOUSE**

3 Cold Climate Housing Research Center, “Home Rebate Program Outcomes”, 2012

PROGRAMMATIC TENSION BETWEEN FOREST SEQUESTRATION AND HOME WEATHERIZATION



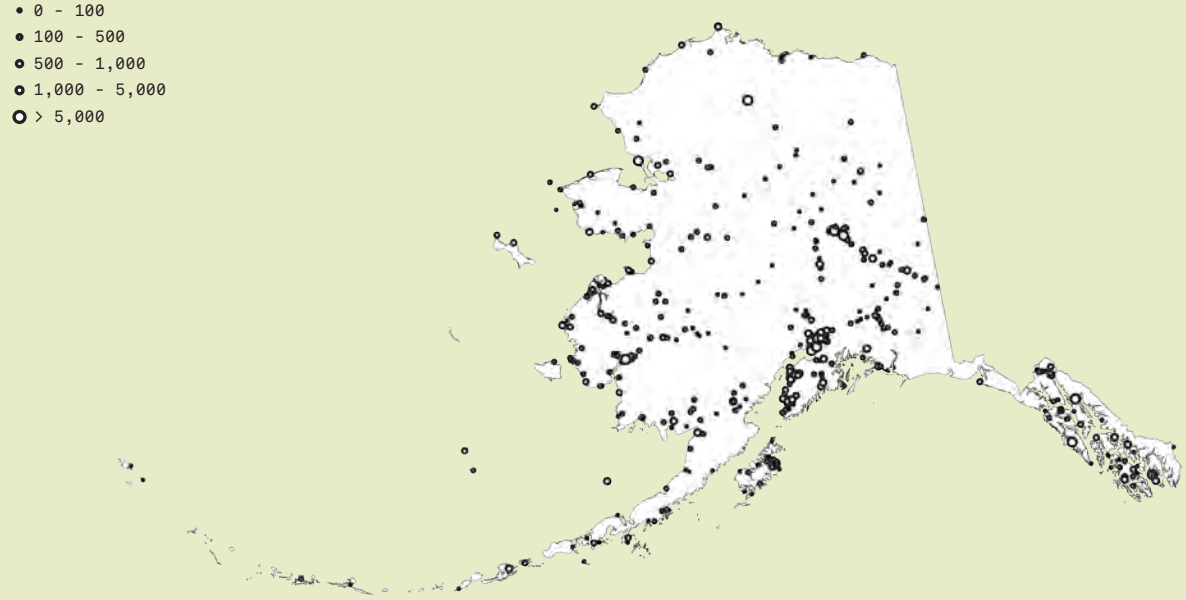
BOX 2.3

Prototypical Site Selection

COMMUNITIES: POPULATION

(SOURCE: Alaska Energy Data Inventory)

There are approximately 280 communities in AK.



Our project is not recommending a specific community for implementation. Rather, we are recommending that an unregulated entity identify an appropriate partner for a project, and build a collaborative relationship with it. However, our proposal calculations rely upon a prototypical site selection using three criteria:

- Native Corporation-owned forested land within the CARB Alaska super section;
- Land that does not have subsurface coal deposits; and,
- Land that is adjacent to a number of communities where a weatherization program could be implemented along with the sequestration program.

The following analytical maps illustrate how these criteria can be utilized to narrow down potential sites and project partners.

We studied three sites as potential project areas for our proposal:

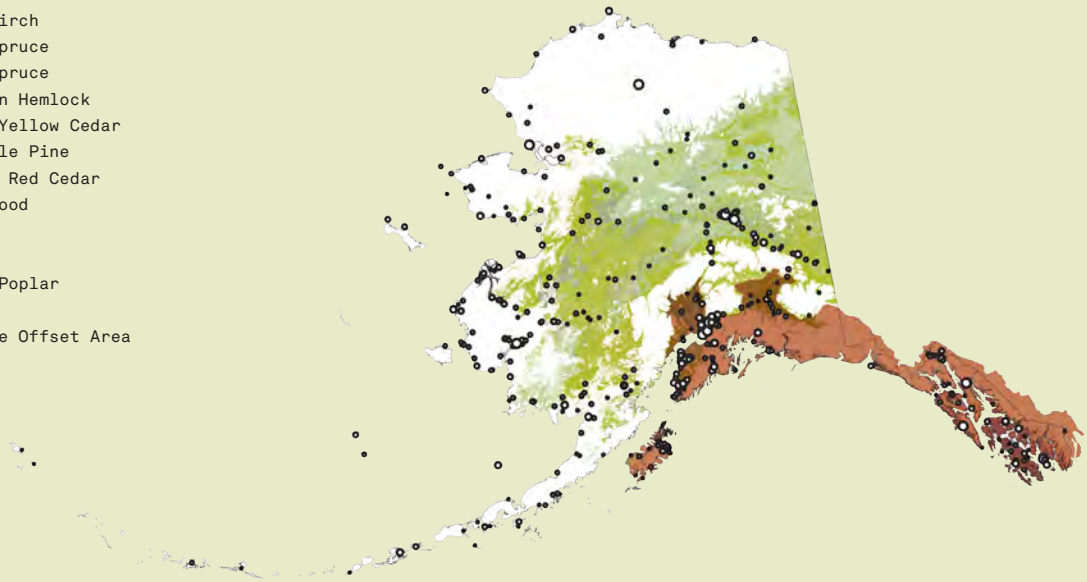
FOREST TYPES: CARB PROTOCOL AREA

(SOURCE: USDA Forest Service 2008; California EPA Air Resources Board)

The California carbon trading system recognizes forest sequestration offsets from Southeast AK.

- Sitka Spruce
- Western Hemlock
- Paper Birch
- White Spruce
- Black Spruce
- Mountain Hemlock
- Alaska Yellow Cedar
- Lodgepole Pine
- Western Red Cedar
- Cottonwood
- Willow
- Aspen
- Balsam Poplar

- Eligible Offset Area

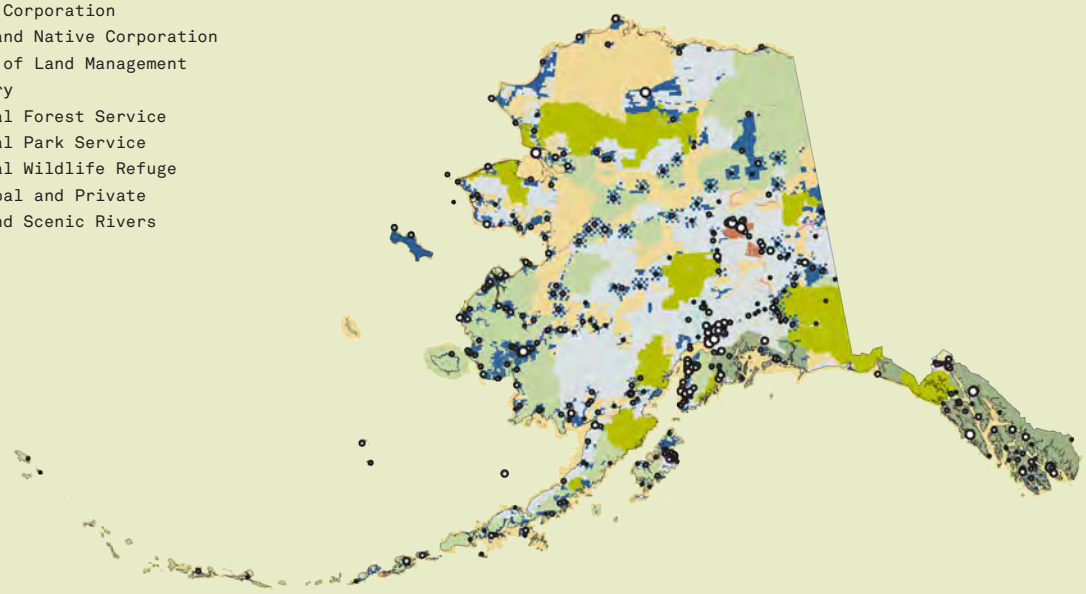


LAND OWNERSHIP

(SOURCE: AK Department of Natural Resources)

We are looking for areas where forests are owned by Native Corporations (blue areas).

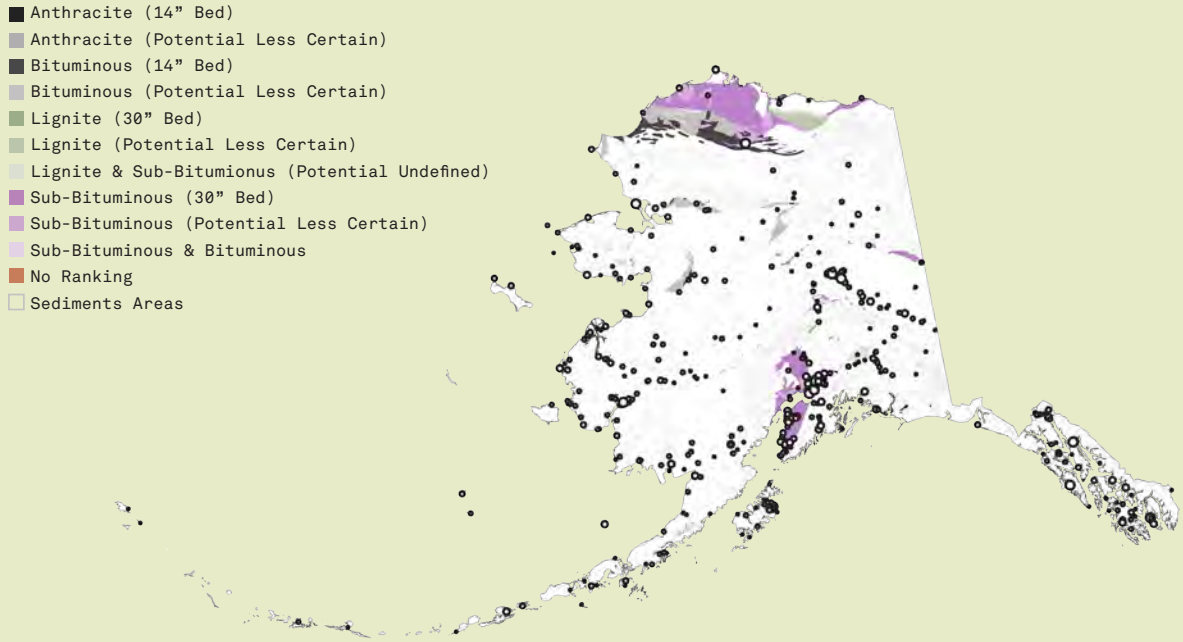
- Native Corporation
- State and Native Corporation
- Bureau of Land Management
- Military
- National Forest Service
- National Park Service
- National Wildlife Refuge
- Municipal and Private
- Wild and Scenic Rivers



COAL DEPOSITS AND GEOLOGY

(SOURCE: AK Division of Geological & Geophysical Surveys Special Report 3 (1984); USGS)

Coal reserves are primarily located in Cook Inlet and the North Slope; we are aiming to avoid forests that overlay with coal.



1. Carbon Mountain

Carbon Mountain is an ideal site, and is the site of the Chugach offset deal, a key precedent for our project.

2. Cook Inlet

An area of eastern Cook Inlet has native corporation-owned forests where there are four adjacent villages with 11,000 residents. However, this forest is located on top of 30" sub-bituminous coal deposits.

3. Afognak / Raspberry Island

Afognak and Raspberry Islands are an area of Kodiak where there are about 150,000 acres of Sitka Spruce forest. This forest is neighbored by three villages – Port Lion (population 256), Ouzinkie (population 225), and Aleneva (population 68). This forest is free of coal deposits, and therefore is an ideal site for our sequestration project.

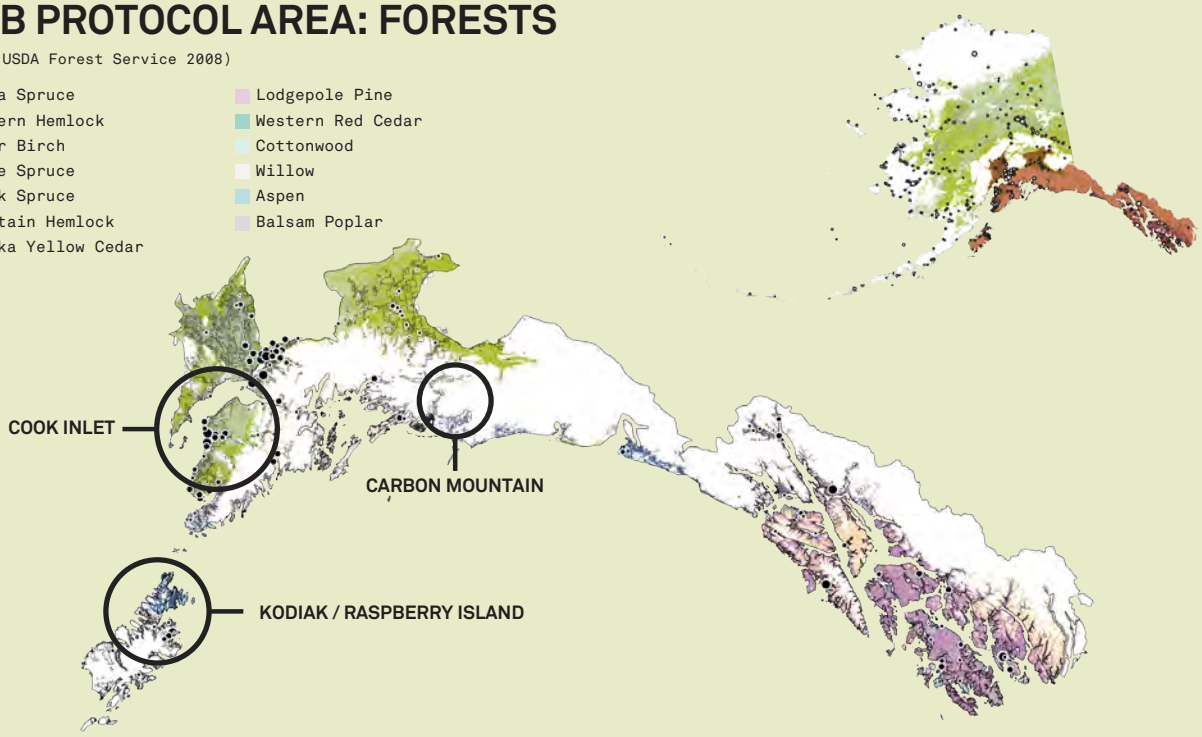
This forest has five owners: Afognak, Leisnoi, Ouzinkie, and Shuyak Corporations and Natives of Kodiak. A project on Raspberry Island may have to contract with these five entities.

However, a small project might only locate within the land of one native corporation and therefore does not have to negotiate with the other four corporations.

CARB PROTOCOL AREA: FORESTS

(SOURCE: USDA Forest Service 2008)

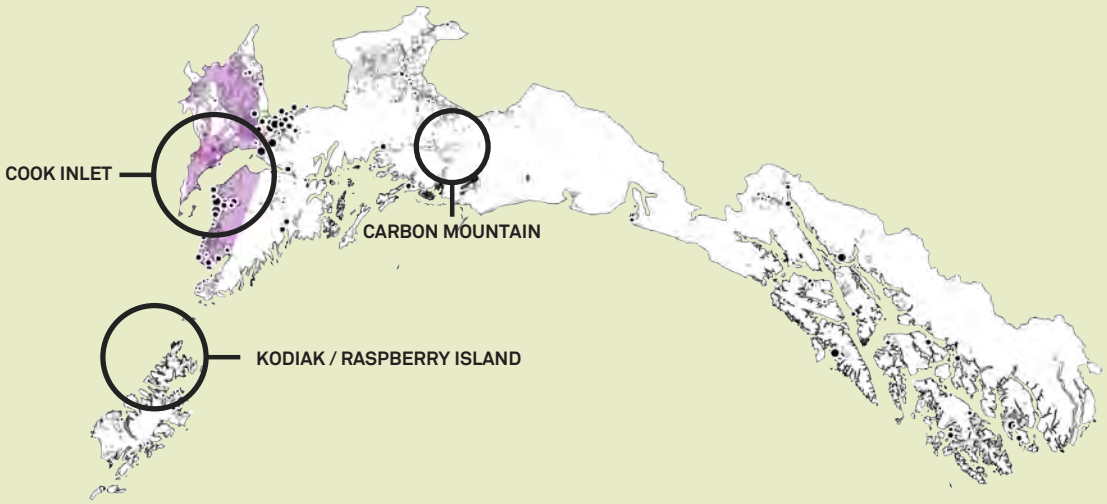
- Sitka Spruce
- Western Hemlock
- Paper Birch
- White Spruce
- Black Spruce
- Mountain Hemlock
- Alaska Yellow Cedar
- Lodgepole Pine
- Western Red Cedar
- Cottonwood
- Willow
- Aspen
- Balsam Poplar

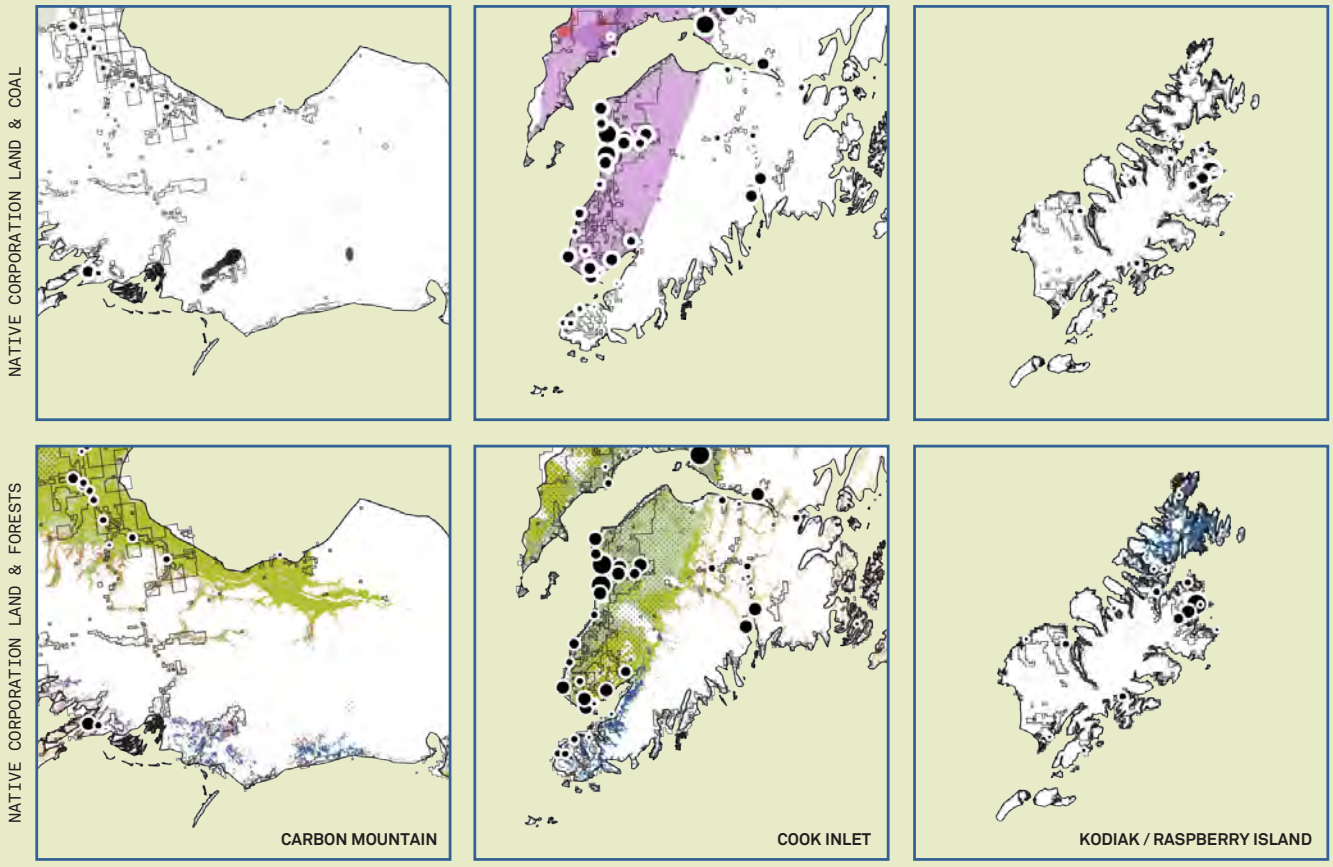


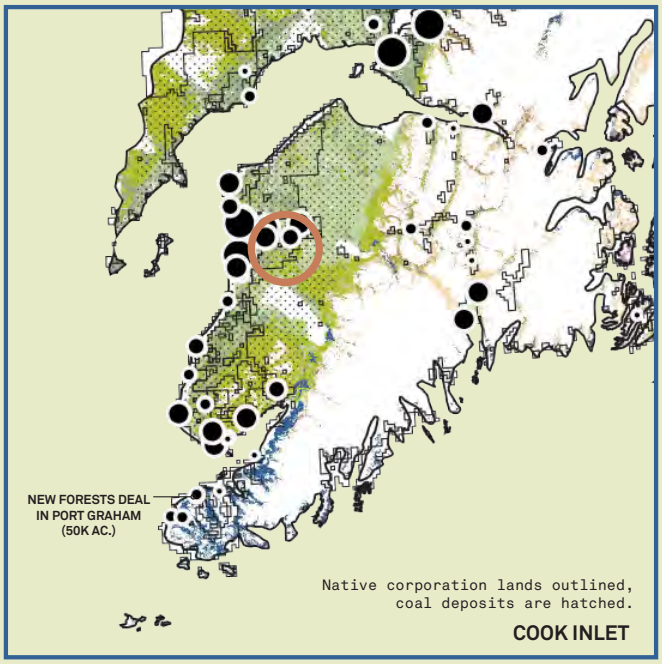
CARB PROTOCOL AREA: COAL RESERVES

(SOURCE: AK Division of Geological & Geophysical Surveys Special Report 3 (1984);
AK Department of Natural Resources)

- Anthracite (14" Bed)
- Bituminous (14" Bed)
- Bituminous (Potential Less Certain)
- Lignite (30" Bed)
- Lignite & Sub-Bitumionus (Potential Undefined)
- Sub-Bituminous (30" Bed)
- Sub-Bituminous (Potential Less Certain)
- No Ranking
- Native Corporation-Owned
- Native Corporation- / State-Owned

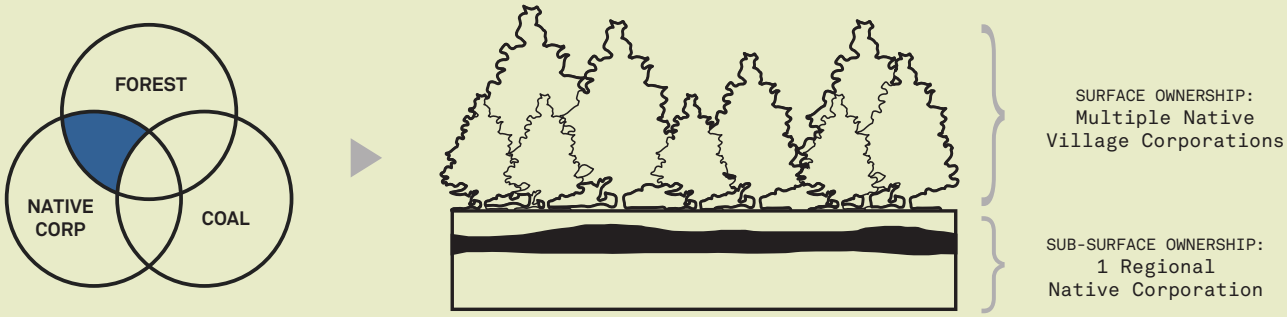



NATIVE CORPORATION LAND & COAL
NATIVE CORPORATION LAND & FORESTS
CARBON MOUNTAIN
COOK INLET
KODIAK / RASPBERRY ISLAND


NEW FORESTS DEAL
IN PORT GRAHAM
(50K AC.)
Native corporation lands outlined,
coal deposits are hatched.
COOK INLET


Native corporation lands outlined,
coal deposits are hatched.
KODIAK / RASPBERRY ISLAND

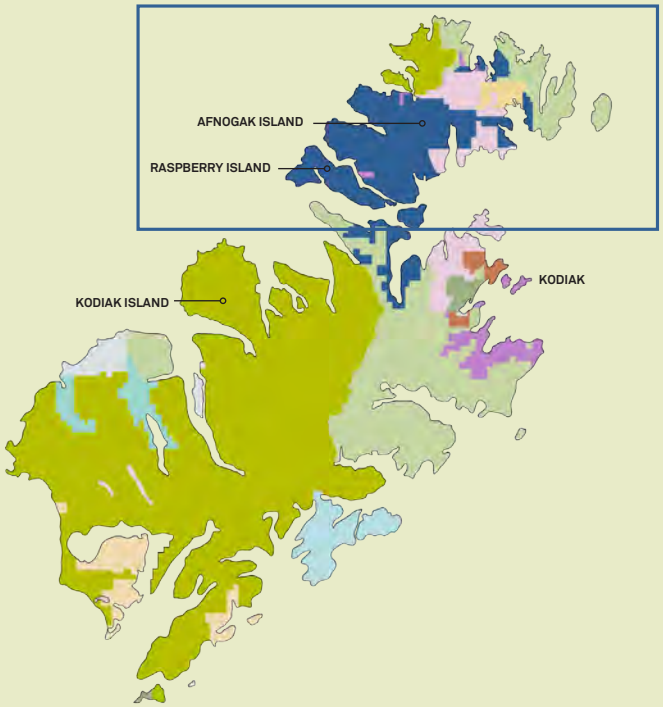
KEY SITE SELECTION AND OWNERSHIP CRITERIA



LAND OWNERSHIP: KODIAK

(SOURCE: Diagram from Kodiak.org)

OWNER	ACRES
Afnogak Native Corporation + JV	321,280
Ouzinkie Native Corporation	98,560
Leisnoi, Inc.	47,360
Natives of Kodiak	16,000
Akhiok / Kayugak	65,280
Kodiak Island Borough	16,000
Koniag, Inc.	33,920
Koniag Conservation Easement	46,720
Old Harbor Native Corporation	67,200
State of Alaska	44,2240
US Coast Guard	16,640
US Fish and Wildlife Service	48,000



The Afognak, Leisnoi, Ouzinkie, and Shuyak Corporations and Natives of Kodiak own a combined land area of about 480,000 acres; not all of this is forested land, so the actual forest area is about 150,000 acres. Our proposal is to sequester 16,000 acres.

PROPOSED PROJECT SEQUENCE

Below is the general sequence of events that must occur to plan, execute, and audit a carbon sequestration project within this context.

Project Idea and Preliminary Assessment

- Identify all objectives of the forest carbon project
- Locate an Alaska Native Village Corporation partner and settle on the project scale, area, and boundaries. Draft a Memorandum of Understanding
- Ensure the Alaska Native Village Corporation has clear title to the lands
- Publish a Request for Proposals for forest carbon project developers
- Request forest data from the Forest Service Inventory
- Identify all other project participants, including the Alaska Native Regional Corporation, any relevant municipalities, a certified land bank if the proposed forest area sits over subsurface minerals, contractors/an ESCO, certified auditors, and any other local stakeholders
- Re-evaluate financing, costs, benefits, risks, and draft a project note
- Conduct a feasibility assessment with expert input
- Begin community engagement process
- Conduct the screening and scoping phases of the Health Impact Assessment
- Reassess the design of the project

Project Design and Planning

- Ensure the forest carbon project falls within the scope of the CARB Protocol (or another established carbon offset protocol, provided the unregulated entity and project developer agree)
- Formally agree on the management and allocation of carbon revenues and rights to claim offsets, using legally-binding agreements. Distribute costs, risks, and benefits
- Prepare a roadmap/budget and work plan while recognizing the time frame necessary before the offsets are verified
- Engage a local attorney with experience dealing with ANCSA and ANILCA to conduct due diligence and confirm carbon offset rights may be transferred
- Clearly define the activities and engage the Regional Corporation to account for the subsurface estate
- Conduct the assessment, reporting, and recommendation phases of the Health Impact Assessment

Forest Carbon Project Developer Provides a Project Design Document

- Perform the necessary GPS and GIS studies and verified baseline assessments
- Conduct a thorough community engagement process to ensure local buy-in to the project
- Quantify the offset potential, the leakage assessment, and the non-permanence risk assessment (due to events such as earthquakes

and landslides)

- Lower the leakage discount with appropriate site selection and design, if possible

Reassess and Adjust

- Adjust the project activities, financial projections, and budgets if necessary
- Reassess what additional benefits may be derived from the forest carbon aspects of the project

Finalize Arrangement

- Negotiate and draft a carbon transaction agreement, which includes delivery of credits, allocating risks and liabilities, dealing with remedies, warranties and representations, etc. Include monitoring, reporting, validation, and verification obligations, representations and warranties, etc.

Forest Carbon Project Developer Steps

- The developer obtains documents, permits, approvals, and any secondary approvals
- Continued stakeholder consultation and engagement while employing appropriate methods of consultation
- Validation performed by an audit team that is arranged for by the project developer
- Register the project, which allows it to be formally recognized as eligible to generate credits under the CARB protocol

Implementation and Monitoring

- Implement the project activities over a period of years
- The project developer hands over the management of the forest to the Village Corporation, following the necessary skills training
- Regular monitoring and auditing on an ongoing basis

Weatherization Investments

- Native Village corporation receives weatherization investment from unregulated entity
- Scope of weatherization activities defined
- Local village identified for weatherization activities
- Native Village corporation contracts with ESCO or local contractor to perform weatherization
- Community engagement process conducted by Native Village corporation
- Weatherization of village occurs

Verification and Issuance of Offsets

- Following an auditor review, certification, and report, the offsets are formally issued
- The project developer takes its percentage of the offsets
- The unregulated entity pays the Village Corporation for its share of the offsets, with the possibility of setting up a trust that can pay for the trailing costs of the ongoing audits

FIGURE 2.4: IMPLEMENTATION MECHANISM (Y0-1)

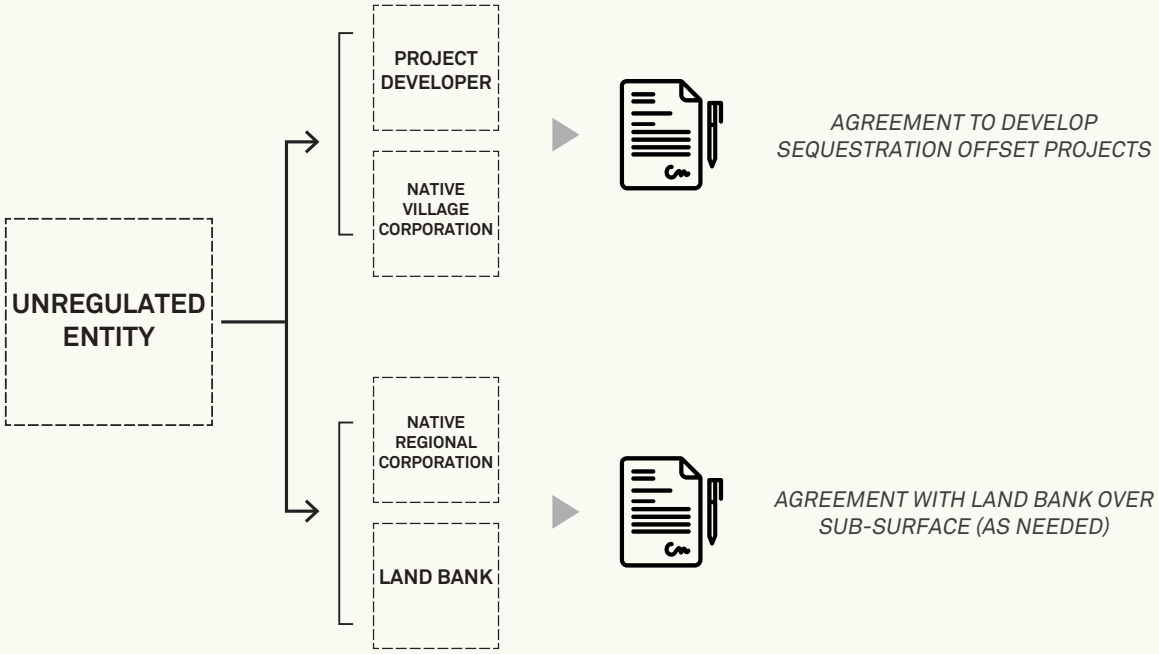


FIGURE 2.5: IMPLEMENTATION MECHANISM (Y1-2)

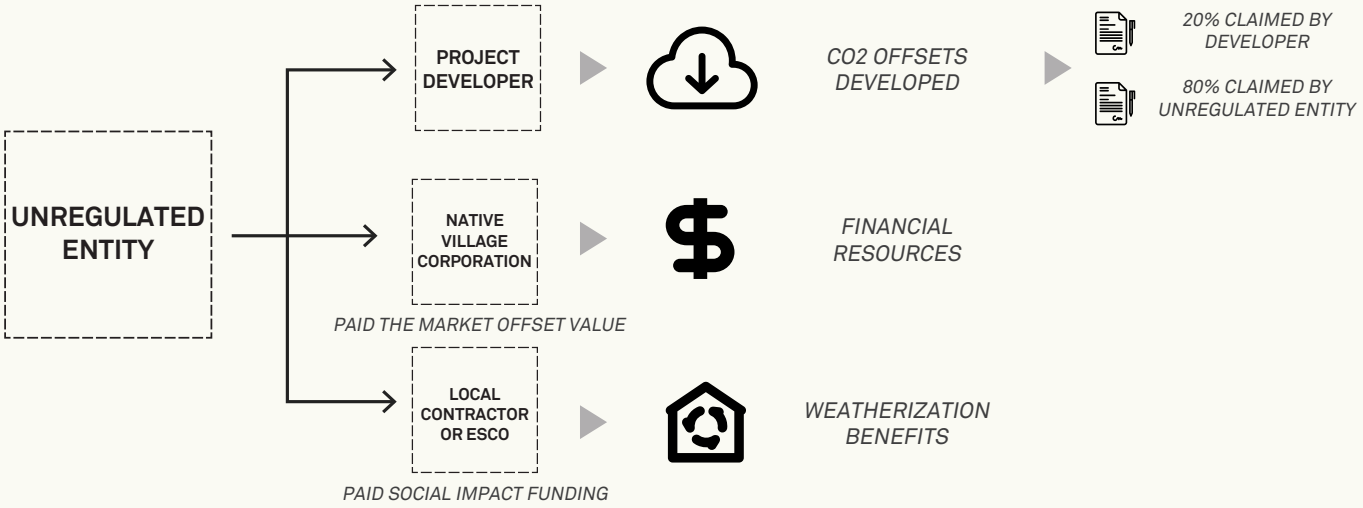


FIGURE 2.6: IMPLEMENTATION MECHANISM (Y3-12)

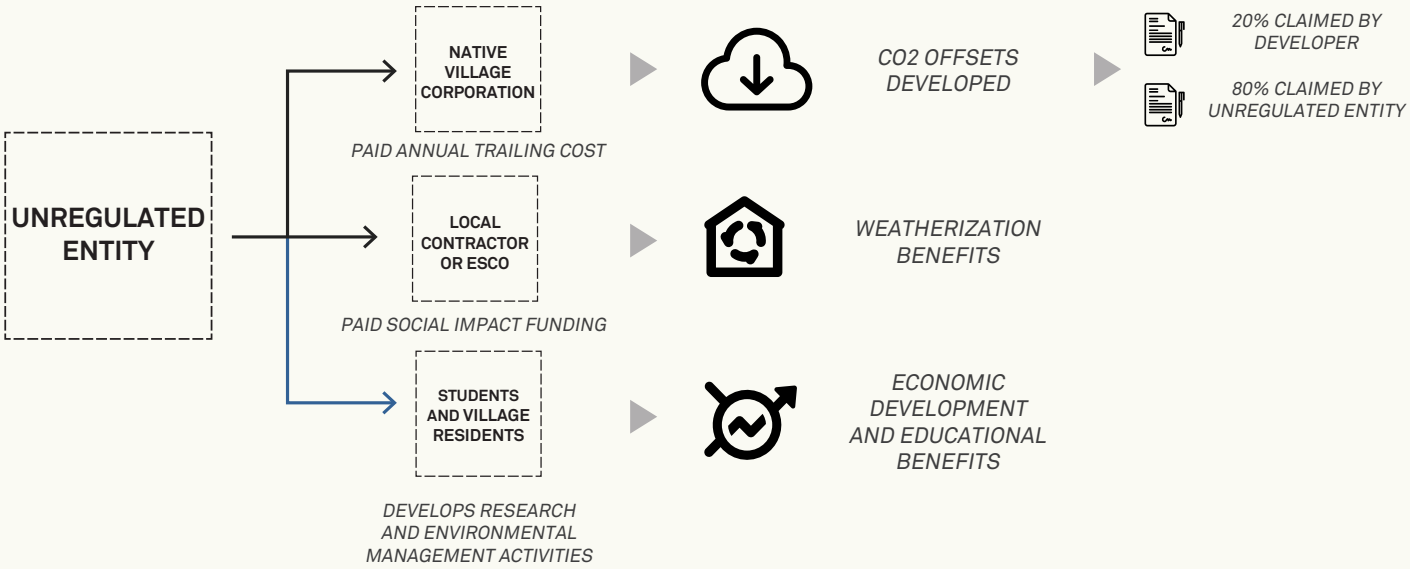
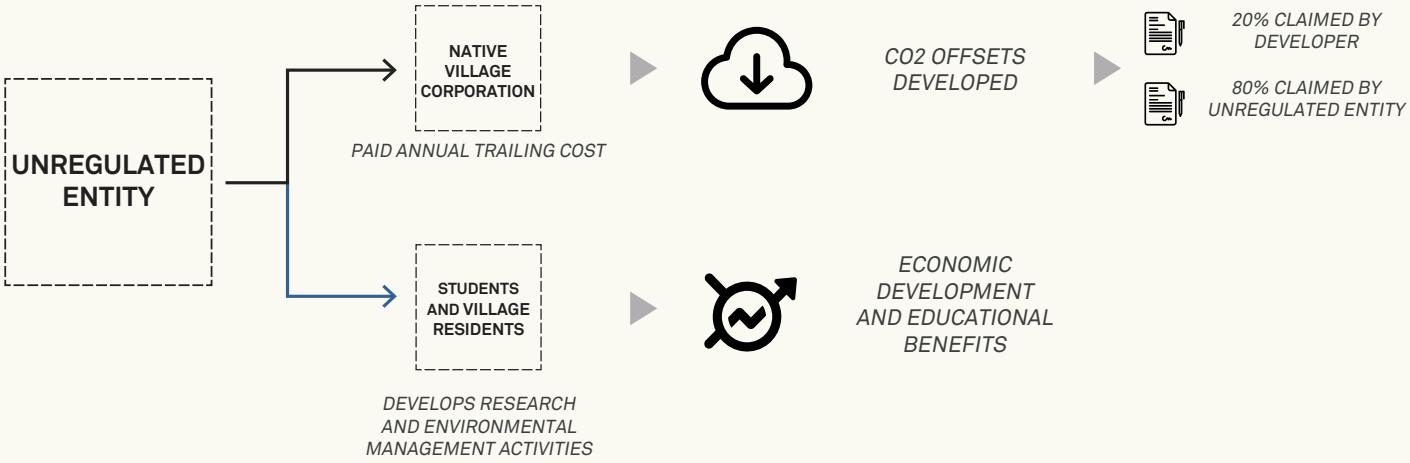


FIGURE 2.7: IMPLEMENTATION MECHANISM (Y13+)



LEGITIMACY AND CREDIBILITY OF OFFSETS

ADDITIONALITY AND RISK

According to the California Air Resources Board (CARB) Compliance Offset Protocol (the Protocol), an IFM project needs to meet the following requirements: 1) forest management criteria, 2) location, 3) verification, 4) increased carbon stock, 5) additionality, 6) permanence. Since the proposed project is located within the eligible area of CARB Compliance Offset Protocol (Box 2.3), the project automatically satisfies the location requirement.

The Protocol requires the Offset Project Operator or Authorized Project Designee to be responsible for offset listing, monitoring, reporting and verification. The Offset Project Operator should be the forest owner or multiple forest owners, which in our case, is the Native Corporation who owns the forest. The Native Corporation should be in charge of the above responsibilities, or it can identify an Authorized Project Designee pursuant to Section 95974 of the CARB Regulation.[1] In our case, the Native Corporation will identify the forest project developer as the Authorized Project Designee in the early years of the project.

The IFM project also needs to satisfy forest management requirements set forward in the Protocol and find a certified third-party verifier to verify the legitimacy and credibility of the project. It is the verifier's responsibility to ensure that such requirements are met. While IFM allows for some commercial harvesting, the verifier must ensure that sustainable harvesting practices are employed in all forestlands, which means that harvesting does not lessen the forest's carbon uptake. In addition, the IFM project needs to "maintain or increase standing live tree carbon stocks within the project area over any ten consecutive year period during the project life," meaning that the project life should be at least 10 years. There are also additional requirements if the IFM project employs even-aged management practices within the project area. Even-aged management practice stands for IFM projects that result in a group of forests with nearly even tree age. It is often achieved through clear-cutting, followed by single species planting and intermediate thinnings.[2] If the IFM project involves such management practice, it must meet certain harvest unit size and buffer area requirements.

For the carbon offset credit to be eligible, the offset project also has to meet the requirements for increased carbon stocks. Specifically, the offset project must not result in a decrease in standing live tree carbon stocks over 10 consecutive years, and the carbon stock cannot fall below the baseline scenario or 20% below the initial carbon stock at the beginning of the project, whichever is higher. The forest project also cannot employ broadcast fertilization or take place on a previously listed compliance offset forest project. For our proposed project, the contract requires the project developer or operator to report their carbon offset each year and ensures that the above requirements are met.

The proposed project also needs to meet additionality

1 California Air Resources Board. "Modified Regulation Order." 2014. Accessed from https://www.arb.ca.gov/cc/capandtrade/ct_oal_april2014.pdf

2 Kuuluvainen, T., Tahvonen, O., & Aakala, T. Even-Aged and Uneven-Aged Forest Management in Boreal Fennoscandia: A Review. *Ambio*, 41(7), 720–737. 2012. http://doi.org/10.1007/s13280-012-0289-y

criteria. According to the Protocol, two sets of additionality tests are required. The Legal Requirement Test ensures that the emission reductions exceed the reduction requirements of law, regulations or any legally binding mandates. This proposed project satisfies this requirement since there is no legally enforced forest management or emission reduction requirements for the forest land owned by the five native corporations in Raspberry Island. The second additionality test is a Performance Standard Evaluation, where IFM projects automatically satisfies this test if the management projects are required to produce more GHG emission reductions than the baseline estimate requirement. The Protocol outlines the procedure of determining the baseline estimate and it is the project developer's responsibility to comply with such procedure.

Although only the offsets ready to sell to the CARB market need to comply with this Performance Standard Evaluation, it is recommended that such test is used to evaluate all the offset credits of this project, including the ones to be retired by the unregulated entity. Compared to a project-specific standard, there are three reasons to use performance-based standard for IFM projects.

1. Since IFM is a popular carbon offset project and is being transacted across several carbon markets, the performance standard tests for IFM are well established and implemented.

2. Similar IFM projects from Alaska have already been transacted in the CARB market, making it easier and cheaper to follow the Performance Standard Evaluation using experience and data from similar projects. Compared to a project-specific additionality test, the Performance Standard Evaluation proposed by the CARB will be cheaper to follow.

3. Given that the CARB market is a well-established carbon market, its Performance Standard Evaluation ensures a high level of credibility.

As for the permanence issue, the Protocol requires a 100-year project life to be considered as "permanent." Also, the project needs to submit annual reports and be verified every six years. Therefore, the proposed project needs to have a project life of at least 100 years to be eligible for CARB offset.

ADDITIONALITY RISK

The proposed project suffers a risk of carbon leakage, due to the limited area of protected forest. According to the data provided by Alaska Department of Natural Resources, the total forest area on the northern island of Kodiak (Raspberry Island) is about 150,000 acres, while this proposed project only covers approximately 18,000 acres. If the project only protects the forest area within 18,000 acres, the rest of the forest is still in danger of being deforested or unsustainably managed. If this IFM project results in the Native Corporation

developing the rest of the forest area, this project will create potential carbon leakage.

To reduce this leakage risk, three strategies are being adopted:

1. The project incorporates 10% buffer for permanence risk and 5% buffer acres for leakage risk. The idea of a buffer area is that the project will set aside 7,750 metric tons of offsets in addition to the 50,000 metric tons of carbon offset to be retired by the unregulated entity. If a permanence or leakage issue occurs and the amount of emission reduction decreases, the buffer offset will be used to make up for underperformance. This is consistent with the buffer pool required by CARB Protocol.

2. The contracts of this project listed out terms that explicitly prohibit the Native Corporation to develop additional forests within their own territory or collaborate with other Native Corporations to unsustainably develop forests outside of this project zone. By preventing the Native Corporation to explore forests elsewhere than the protected zone, the contract can reduce the leakage issue.

3. The unregulated entity may choose to form a consortium with other unregulated entities to secure the total area or at least the majority of the forest area and ensure sustainable management of the entire forest. By securing the entire forestland in Raspberry Island or at least that of one Native Corporation, the consortium can reduce the leakage risk.

In addition to these risk mitigation measures, the unregulated entity or the project operator might also inquire into the possibilities for monitoring leakage through hiring contractors, arranging site visits, building a remote research station, or exploring the use of contractual terms that provide guarantees from the Native Corporation. If the unregulated entity was a university or group of universities, they may be interested in installing monitoring stations in the forest to confirm the success of the sequestration, as well as collect a variety of other data.

The project may also face leakage risk if the underground mineral resources are being developed regardless of the improved forest management efforts. Therefore, this project will target only on forest areas with no or limited amount of subsurface mineral resources. Part of the rationale for selecting the Kodiak Island's forests was the absence of known mineral deposits, eliminating this potential risk.

Other natural risks include wildfires, blight, earthquake, infestation, etc. The buffer pool of this project is designed to account for some of these risks, and the unregulated entity should ask the forest carbon project developer about best practices in terms of managing those risks on other, similarly situated forest projects in Alaska.

PROJECT CO-BENEFITS

SOCIAL, ECONOMIC, AND HEALTH OUTCOMES

The benefits of this type of carbon sequestration project are numerous, but can be difficult to quantify. Ultimately, the quantity and quality of benefits depend significantly upon how much the unregulated entity is willing to invest above and beyond the required payment to the Native Alaskan village in exchange for the carbon offsets themselves. Below are descriptions of the numerous benefits that can be generated:

Educational

- Research opportunity for or a university if it is the unregulated entity, particularly if the university can negotiate for access to a monitoring station in the forest that would measure health impacts and collect data for future sequestration projects
- University student visits, if a university is the unregulated entity
- Local school ecology education
- Training for monitoring, auditing, data gathering activities

Social Capital and Heritage

- Assuring subsistence lifestyle for Alaskan Natives
- Opportunities for capacity building within the Native Village corporation
- Securing integrity of the ecosystem and associated health benefits
- Securing historic lands

Economic Development

- Mechanism for sustainable management of forest - more productive economically in the long-term
- Long-term stability of native corporation; alternative to logging as a response to financial crisis
- Investment in buildings with related construction jobs and energy savings

Ecological Diversity

- Superior implementation of IFM enables ecological diversity of the land

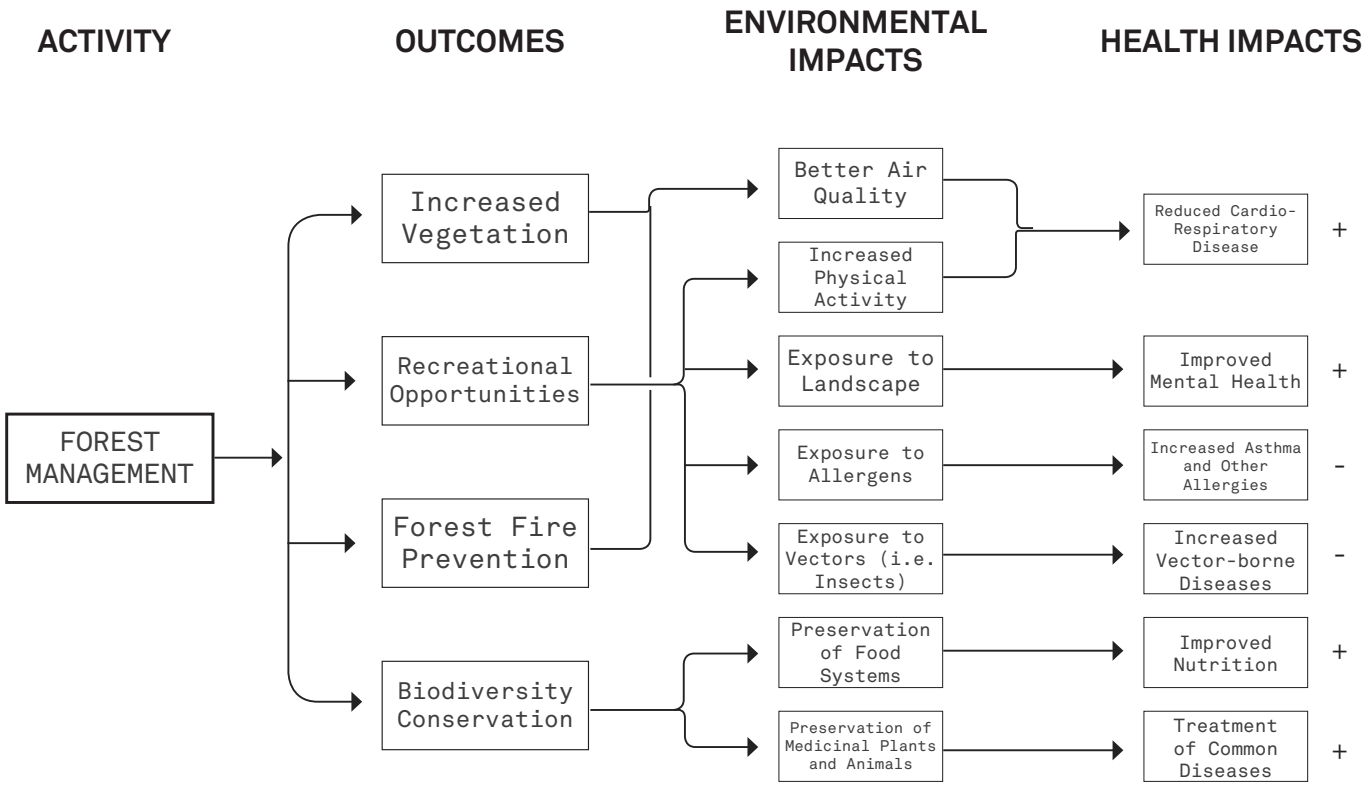
Institutional Advancement

- Cooperative relation with Native communities, consistent with consistent with educational mission, if a university is the unregulated entity

Unintended Consequences

- Potential for social disruption, or reinforcing existing inequalities in the community
- Unforeseeable value – the loss of future opportunities
- Burdensome lifestyle changes (e.g., someone may need to travel further to collect a resource because of land restrictions)

FIGURE 4.1: NATIVE VILLAGE HEALTH BENEFITS



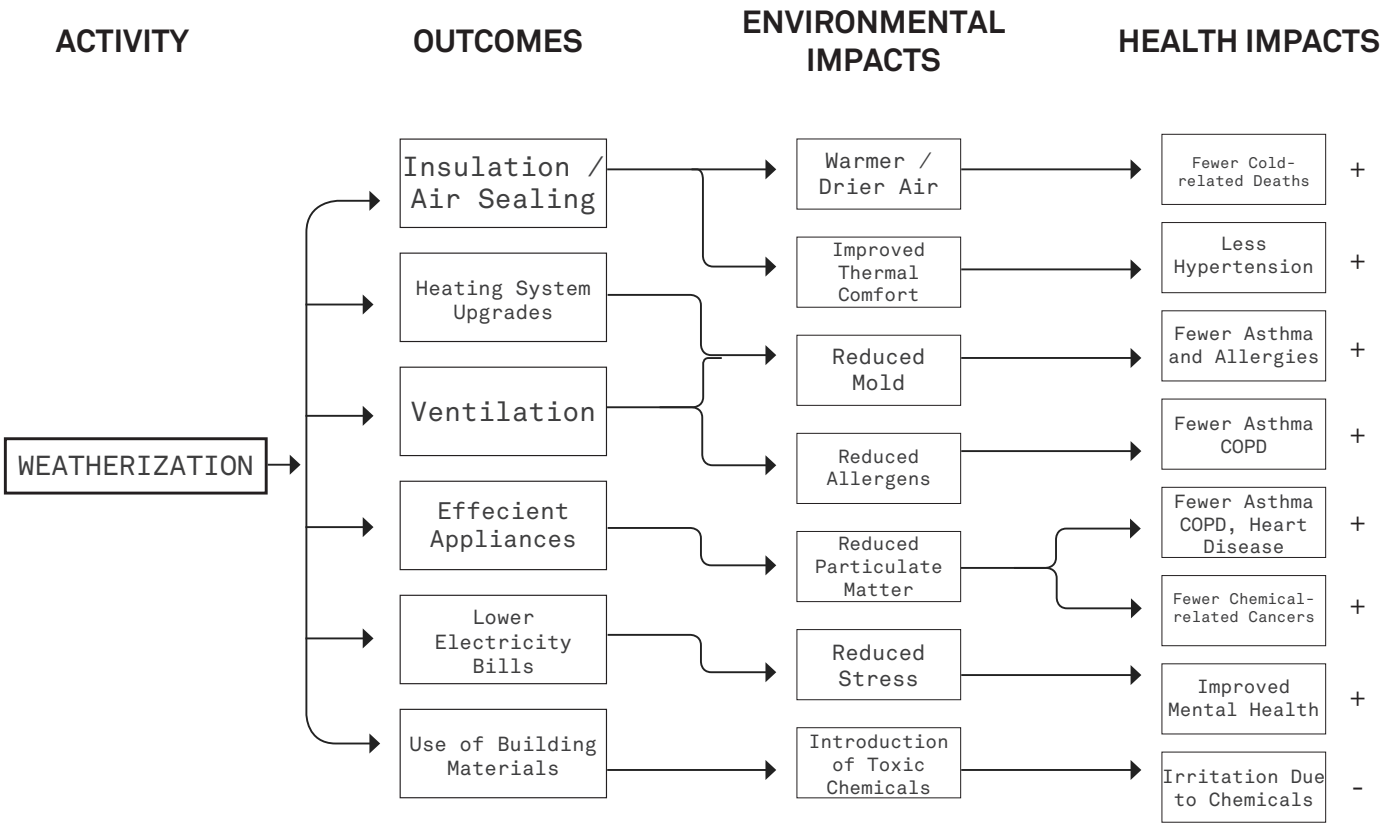
PUBLIC HEALTH BENEFITS

In addition to the social, educational, economic, and environmental benefits listed above, this project will also generate a wide range of public health benefits for Native Alaskan communities. These health benefits will be explored and documented in detail through a process called Health Impact Assessment (HIA). The conduct of an HIA prior to implementation of the project is highly recommended given the project's scale as well as potential impact on marginalized groups such as Native Alaskan communities. The HIA will provide information for planning and decision-making so that the project's health benefits are maximized and the anticipated health risks are mitigated. Furthermore, the HIA provides a baseline for pursuing collaborative research to deepen understanding of the links between health and the environment, particularly forest management and home weatherization. Appendix D describes the HIA process in detail.

Both forest management and weatherization will produce their own set of public health benefits. For forest management, some of the causal pathways that lead to health outcomes are known, but there could be other pathways that are yet to be explained through research. This project therefore can provide an opportunity for discovery of other health benefits brought about by forest ecosystem services.

Meanwhile, there is a growing body of evidence on the

FIGURE 4.2: NATIVE VILLAGE HEALTH BENEFITS



health benefits resulting from weatherization of homes and other buildings. While studies have estimated these health benefits in quantitative terms, calculations for the potential health benefits of home weatherization in Alaskan villages can only be made once a full assessment of the actual situation of homes as well as weatherization requirements has been conducted. Nonetheless, this section presents some of the health benefits evidence as shown in previous studies.

Protecting the forest through this project will present possibilities to improve human health conditions especially in Alaska. Forests supply an abundance of ecosystem services that help in creating healthy living environments. However, as in every project, there are also potential health risks that will need to be examined and anticipated so that necessary mitigation measures can be implemented. Figure 4.1 presents some of the known pathways that lead to health benefits and risks (the main risk is vector borne diseases) resulting from improved forest management.

Woodlands and trees have a positive impact on air quality through deposition of pollutants to the vegetation canopy, reduction of summertime air temperatures, and decrease of ultraviolet radiation.[1] Protected forests also offer recreational opportunities which provide significant contributions to increased

1 Karjalainen, E., Sarjala, T., & Raitio, H. (2010). Promoting human health through forests: overview and major challenges. *Environmental Health and Preventive Medicine*, 15(1), 1–8. http://doi.org/10.1007/s12199-008-0069-2

physical activity among people.[2] A forest experience, through exposure to greenness, can also contribute to improved emotional and cognitive health, such as recovering from stress, improving concentration and productivity, and improving the psychological state. These improvements in health have physiological effects such as decreased blood pressure and heart rate and reduced anxiety and stress.[3] However, people who pursue recreational activity inside the protected forest may then be exposed to allergens such as pollens as well as vector-borne diseases endemic in temperate forests. Meanwhile, forests also represent rich natural pharmacies by virtue of being enormous sources of plant and microbial material with known or potential medicinal or nutritional value.[4] Since Native Alaskans also rely on forests for their food, protecting the forest will preserve natural food systems, which will may help enhance, if not improve, the community's nutritional status.

Weatherization of homes and buildings also present a wide range of health benefits of its own. Figure 4.2 presents the health benefits as well as risks of weatherization, particularly to occupants.

Occupants of houses that undergo combined weatherization and heating system upgrades will live in drier homes with more consistent temperatures, fewer air indoor pollutants, reduced allergens, and fewer asthma triggers (such as changes in temperatures, dampness, mold, mice, or cockroach droppings). The same benefits can be enjoyed by community members utilizing public and commercial buildings that will be retrofitted. A recent review of 12 studies of residential energy efficiency and two studies of related ventilation strategies all document some improvement in occupant health or indoor environmental conditions.[5] Based on studies in the United States and Canada, below are some examples of the documented health benefits of weatherization that can also be applied in the Alaskan context:

Improvements in overall health

One study[6] observed a 48% reduction in the days during the previous month residents reporting their physical health was "not good." A second study demonstrated 13% reduction of those reporting their health was "fair or poor."[7]

Some improvement in symptoms, hospital use, or medication use related to asthma

Three US studies[8] of low income homes showed: 12%

2 Kline, Jeffrey D.; Rosenberger, Randall S.; White, Eric M. 2011. A national assessment of physical activity on US national forests. *Journal of Forestry*. 109(6): 343-351.

3 Shin, W. S., Yeoun, P. S., Yoo, R. W., & Shin, C. S. (2010). Forest experience and psychological health benefits: the state of the art and future prospect in Korea. *Environmental Health and Preventive Medicine*, 15(1), 38–47. http://doi.org/10.1007/s12199-009-0114-9

4 Karjalainen, E., Sarjala, T., & Raitio, H. (2010)

5 E4 The Future (November 2016). Occupant Health Benefits of Residential Energy Efficiency. Available from: https://e4thefuture.org/wp-content/uploads/2016/11/Occupant-Health-Benefits-Residential-EE.pdf.

6 Tonn B, Rose W, Hawkins B, Conlon B. (2014) Health and household-related benefits attributable to the weatherization assistance program. Oak Ridge National Laboratory. Env Sciences Division. ORNL/TM-2014/345.

7 Wilson J, Dixon S, Jacobs D, Breysse J, Akoto J, Tohn E, Isaacson M, Evens A, Hernandez Y. (2014). Watts-to-Wellbeing: Does residential energy conservation improve health? Energy Effic. 1– 10. doi:10.1007/s12053-013-9216-8.

8 Tonn B, Rose W, Hawkins B, Conlon B. (2014); Wilson J, Dixon S,

reduction in asthma-related ED use; a predicted six-fold reduction in the likelihood of visiting an emergency department; greater than $400 decline in annual Medicaid costs and fewer Medicaid claims; and a trend toward a 20% reduction in use of asthma "rescue" medicines.

Improvements in respiratory health are strongest among vulnerable groups

Several studies[9] have shown that those who benefited greatly are those from lower income households and residents with pre-existing health conditions linked to housing risks (asthma or other respiratory risks).

Improvements in mental health

One report[10] documented a 48% reduction in the number of days in the past month a resident reported poor mental health.

Meanwhile, weatherization, if not properly done, may introduce some health risks. For instance, the use of new building materials in the weatherization process may introduce toxic chemicals like volatile organic compounds that may irritate the eye, nose, and throat; however, the risk is minimal.

The challenge with public health benefits is that most of them, especially the ones gained from forest management, are difficult to quantify. While the pathways that produce health benefits have been identified, these pathways are deeply intertwined and affected by many external factors. Hence, trying to establish linear causal relationships will be impossible and also inappropriate. Nonetheless, qualitative descriptions of health benefits, as well as perception studies by local residents, for example in terms of effects of greenness on stress relief, can later be measured once the project is implemented and the proposed collaborative research has commenced.

Meanwhile, while the causal pathways are more established for weatherization, the rates calculated in the limited studies reviewed must be used with caution when estimating for potential health impacts of a specific project, especially during the conduct of the Health Impact Assessment. The context where the studies have been conducted may differ from the unique Alaskan context. For instance, two of the aforementioned studies[11] were done in Washington state, which has a different environment compared to Alaska.

Jacobs D, Breysse J, Akoto J, Tohn E, Isaacson M, Evens A, Hernandez Y. (2014); Rose E, Hawkins B, Tonn, B, Paton D, Shah L. (2015) Exploring potential impacts of weatherization and healthy homes interventions on asthma-related Medicaid claims and costs in a small cohort in Washington State. Oak Ridge National Laboratory. Env Sciences Division. ORNL/TM-2015-213.

9 Tonn B, Rose W, Hawkins B, Conlon B. (2014); Tonn B, Rose W, Hawkins B, Conlon B. (2014); Rose E, Hawkins B, Tonn, B, Paton D, Shah L. (2015); Howden-Chapman P, Matheson A, Crane J, Viggers H, Cunningham M, Blakely T, Cunningham C, Woodward A, Saville-Smith K, O'Dea D, Kennedy M, Baker M, Waipara N, Chapman R, Davie G. (2007). Effect of insulating existing houses on health inequality: Cluster randomised study in the community. BMJ (Clinical Research Ed.), 334(7591), 460. doi:10.1136/bmj.39070.573032.80; Breysse J, Dixon S, Gregory J, Philby M, Jacobs DE, Krieger J. (2014). Effect of weatherization combined with community health worker in-home education on asthma control. *American Journal of Public Health*, 104(1), 57. doi:10.2105/AJPH.2013.301402

10 Tonn B, Rose W, Hawkins B, Conlon B. (2014)

11 Breysse J, Dixon S, Gregory J, Philby M, Jacobs DE, Krieger J. (2014); Rose E, Hawkins B, Tonn, B, Paton D, Shah L. (2015)

APPENDIX A

RELEVANT LAWS AND CONTRACTING WITH NATIVE CORPORATIONS

FOREST CARBON COMPONENT

1971 Alaska Native Claims Settlement Act (ANCSA)

- Federal law
- Transfer of property rights in exchange for extinguishment of native land claims
- Village Corporations (173) and Regional Corporations (12); distinct from tribal governments, Venetie (1998) case
- Subject to state corporate laws with some exceptions (Alaska Stat. § 10.06.960)
- For-profit entities, but may provide health, education, or welfare benefits in their Articles of Incorporation (e.g. managing leases, building wind turbines, distributing firewood, etc.)
- Subsistence use is the primary or highest-priority use of the land

7(i) and 7(j) provisions

- 7(i) requires 70% of "all revenues received" by each regional corporation from the "timber resources and subsurface estate patented to it" be divided among the 12 regional corporations according to the number of natives
- The regional corporations have the obligation to distribute 50% of the 7(i) revenues to village corporations pursuant to 7(j)
- The 7(i) and 7(j) provisions are only applicable to the Regional Corporations, and thus are inapplicable to a project with a Village Corporation
- 7(n) provision: regional corporation acting on behalf of village

Other Laws

- Subsurface estate v. surface estate
- 21(d)(1) provision: no restrictions on land conveyance (same with State law)
-
- 1987 Alaska National Interest Lands Conservation Act (ANILCA)

Exempted ANCSA land from adverse possession and creditor claims

- Exemptions only apply so long as the lands are "not developed or leased or sold to third parties"
- "Developed" or "leased" means put to "gainful and productive present use", excludes surveying, exploration, and subsistence

WEATHERIZATION COMPONENT

Procurement laws vary by municipality

- Typically, competitive bidding

- Formal arrangement with municipality, seek waiver of procurement requirements in exchange for a guarantee of contracting with competent local firms

Identify all state and federal loans and grant programs that might be leveraged for all projects undertaken

- Renewable Energy Grant Program (dried up)
- Alaskan Power Project Loan Program (dried up) QECBs for regional corporations, CREBs for village corporations
- Alaska Housing Finance Corporation (AHFC) programs for home heating
- Low-interest small building material loans from AHFC if house did not benefit from Weatherization Assistance Program
- Potential for $10K rebate through AHFC's Home Energy Rebate Program
- AHFC energy efficiency revolving loan fund for public facilities
- Alaska Energy Authority programs
- Department of Energy programs

PRINCIPLES FOR WORKING WITH ALASKA NATIVE COMMUNITIES

- Goal is to provide supplemental benefits and stabilize financial viability of village corporation, but keep in mind some regional/village corporations have managed similar transactions without our "help". Remember be are not "saving" anybody
- No special protocols or generally accepted guidance principles for transferring property rights with native corporations
- Be aware of history and possibility of capacity issues (lack of full time officers or bank accounts)
- Native partners might need assistance in managing the trailing costs of a credible forest project over time; developing mechanisms such as a trust accountant that pays out over time might be helpful
- Technically, these are corporations, but there are other relevant actors, such as tribes themselves, which must be involved in the discussions
- Recognize the potential promise, but also the risk, from a public relations standpoint
- Consider alignment with the University's Charter "the education of English and Indian youth"
- Seek additional input from US government offices that regularly work with native communities such as the Bureau of Land Management
- Free and prior informed consent

Principles of indigenous participation, data sharing, respect for privacy

- See Guidelines for Research, Alaska Federation of Natives
- Principles for the Conduct of Research in the Arctic, US Interagency Arctic Research Policy Committee and the National Science Foundation
- Draft Principles for an Arctic Policy, Inuit Circumpolar Conference

APPENDIX B

CONTRACTS

FOREST CARBON COMPONENT

Primary Parties

- Unregulated entity
- Alaska Native Village Corporation (or Regional Corporation on behalf of Village)
- Carbon project developer

Additional Parties

- Certified Land Bank
- Tribal government
- Municipal government
- Alaska Native Regional Corporation
- Local educational and job training organizations

Tripartite contract

CLEARLY DEFINE TERMS

- "Carbon Standard means the standard selected by the parties in accordance with clause xx that will be used to evaluate whether the Project is likely to, and actually does, yield claimed carbon benefits"
- "Contract Price is the price as determined by the identified offset market at xx time"
- "Project Activities means the activities outlined in the project plan that participating landholders and seller representative undertake in order to enhance carbon sequestration or reduce emissions from deforestation and degradation within the Project Area"

EXPRESS THE PURPOSE OF THE CONTRACT

- To implement an improved forestry management project to secure land for subsistence and other benefits while generating carbon offsets
- Identify the price, duration, and other standard terms

OTHER TERMS IN THE TRIPARTITE CONTRACT

- Representation from the project developer and Native Village Corporation that but for the guaranteed purchase from the unregulated entity, such a project would not occur
- Representation from the Native Village Corporation that they have title to the land and the arrangement complies with all village corporation and relevant municipal procurement laws
- Project developer agrees to convey a percentage of the generated offsets to the unregulated entity, which retains exclusive ownership of those offsets. The unregulated entity agrees to pay a set price at set times to the corporation partner for the offsets generated
- Warranty from corporation and land bank that they

will not claim the carbon offsets

- Guarantee of non-assignment
- More terms in the tripartite contract
- Warranty from project developer, agreeing to perform record-keeping, baseline setting, verification, and audits in conformity with the relevant protocol for the California Air and Resources Board"
- Guarantee to provide site access to unregulated entity for educational purposes, including the right to build observation facilities
- Limitation on unregulated entity liability
- Project developer agrees to contract with qualified Native Corporation shareholders for the performance of verification and auditing, as well as training those shareholders in relevant forest management techniques over several years
- Guarantee from the Village Corporation that it will not make agreements regarding shared income with, nor will it provide special allowances to, neighboring Corporations for logging operations on adjacent lands. This provision is intended to address additionality concerns
- Guarantee of non-assignment, dispute resolution, termination, and change in law provisions
- Provisions for reversal; replacement with comparable offsets

Land Bank Conveyance (in case of mineral deposits)

- Parties: Regional and Village Corporations, Carbon Developer, and Unregulated Entity
- Right to develop subsurface minerals, held by regional corporation, to be conveyed to certified land bank (ANILCA provisions)
- If minerals have declined in value (such as with coal), and the corporation wishes to protect the viability of subsistence living on those lands, the regional corporation might enjoy tax benefits not subject to 7(i) provisions for the sale
- Paid for by elevated project developer fee (as in Chugach arrangement)

WEATHERIZATION COMPONENT

Master Agreement: Tripartite contract between a village corporation, an ESCO or contractor, and the unregulated entity

- Governs all future, discrete work tasks undertaken by the ESCO or contractor in the village

IF AN ESCO

- Provide project savings guarantees
- Unregulated entity contributes cash to revolving loan fund at 0% interest
- ESCO withdraws money to perform projects, pays itself out of energy savings generated and returns a portion of savings to the fund

PROVISIONS INCLUDE

- Clear terms
- Right to site access

- ID parties, set amount of loan, duration, interest rate
- Express the Purpose of the contract: To provide the ESCO or contractor with funding to perform a variety of tasks that fall within defined types for identified village(s)
- Representation from ESCO or contractor: but for the participation of the unregulated entity, the project would not occur
- Guarantee access to baseline, cost, and post-project energy data to measure the conduct studies on the feasibility of future offset projects
- Indemnity from the ESCO or contractor for liability arising from the activity of its subcontractors

Individual Agreements: Contract between the Village Corporation and the contractor or ESCO, with the unregulated entity as a third party beneficiary

- Clear terms
- Right to site access

OTHER PROVISIONS INCLUDE

- Provisions addressing the risk of abandonment
- Limitation on unregulated entity liability
- Right of access for the unregulated entity, both to the site and to information logs
- A representation from the village that but for the funding provided by the unregulated entity, the particular projects would not be performed
- A warranty from the village corporation and contractors that they will make no claims to future RECs or carbon offsets generated by the project, if such credits are feasible
- Identification of the unregulated entity as a third party that receives any potential offset credits

APPENDIX C

CONCURRENT PROGRAMS

ENERGY EFFICIENCY AND RENEWABLE ENERGY PROGRAMS

- The unregulated entity pays into a trust, managed by identified stakeholders, including local residents and appointees of the unregulated entity.
- That trust supports either local contractors or a local ESCO to conduct weatherization, energy efficiency, or other projects that create identifiable health and environmental benefits.
- The unregulated entity may use those projects as an educational or research opportunity, perhaps providing the data necessary to establish protocols for carbon offsets from a variety of innovative projects.
- The local economy benefits and residents' enjoy health benefits as well.

FIELD STATION MONITORING

- If the unregulated entity negotiates access and the right to build observation towers, the project site might serve as a research station for data gathering and continuous monitoring
- Those project sites could provide a learning opportunity for the unregulated entity and local educational programs, as well as provide further information on the effect of such projects on CO2 concentrations.

APPENDIX D

HEALTH IMPACT ASSESSMENT

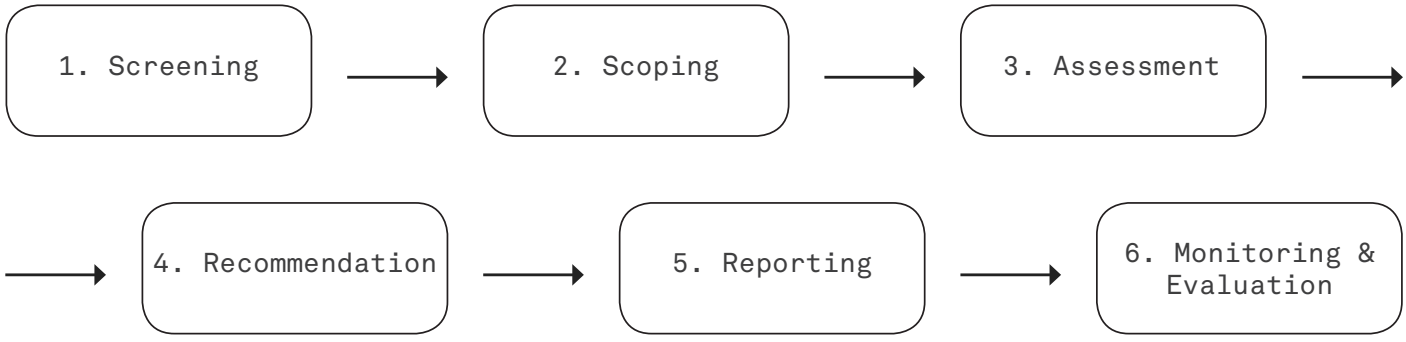
As this project emphasizes the importance of public health, we highly recommend the conduct of a Health Impact Assessment (HIA). The World Health Organization[1] defines HIA as "a means of assessing the health impacts of policies, plans and projects in diverse economic sectors using quantitative, qualitative and participatory techniques." HIA is essential in order to highlight the benefits of a project to population health as well as to identify potential health risks so that decision-makers and project implementers can immediately put in place mitigation measures to manage these risks.

While federal and state laws do not require the conduct of an HIA, the Alaska Department of Health and Social Services (DHSS) established an HIA Program[2] as part of the state's approach to responsible development. To date, DHSS's HIA program has completed two HIAs and is currently undertaking five others, including one coal project and another hydroelectric project. Hence, the HIA for this project can be performed in collaboration with DHSS. Furthermore, since one of the key virtues of an HIA is people's participation, the project proponents and the DHSS must work closely to create a multi-stakeholder HIA task force that will be comprised of public health practitioners from local and state levels, as well as representatives from different local organizations such as the Alaska Native Tribal Health Consortium. External experts from universities

1 World Health Organization. "Health Impact Assessment." Accessed from: http://www.who.int/hia/en/

2 Alaska Department of Health and Social Services. "Health Impact Assessment Program. Accessed from: http://dhss.alaska.gov/dph/Epi/hia/Pages/default.aspx.

FIGURE D.1: HIA PROCESS[1]



1 RWJF (2011), WHO (1999)

that will be part of the consortium, as well as scientists from Alaskan universities will also participate in this HIA process.

The six steps of the HIA process[3] Figure D.1 will be adopted for this project. The first step, screening, has already been performed alongside the general screening procedure for this project, which included the economic, legal, and other aspects. Screening seeks to answer whether a given project proposal requires the conduct of a comprehensive HIA, and whether conducting an HIA will have an impact on decision-making. Our preliminary screening exercise revealed that since this is a large-scale project and has a high likelihood of affecting marginalized populations such as Native Alaskan communities, it is highly recommended that a comprehensive HIA be conducted prior to actual implementation of the project.

Furthermore, apart from health benefits, we also anticipate some potential health risks such as resurgence of infectious diseases, and so a full HIA will aid planners in designing mitigation strategies as soon as possible. While the screening step has already been conducted by the project proponents, this step can also be repeated with local partners and community members to also provide legitimacy to the decision of pushing through with a complete HIA.

The second step, scoping, helps establish a plan for conducting the HIA. One important question is on which pathways are likely to affect health and therefore will need to be included in the investigation. This step also identifies whether there are specific populations that will be affected by the project. The availability of data is also examined, as well as stakeholders that will be involved in the HIA process are also identified. Because this project proposal requires a description of the potential health benefits as well as risks that this project may present, the scoping step was already partly conducted by the team. However, similar to the screening step, the scoping step can also be repeated on the ground with local partners and community leaders to validate what we have identified from the literature as well as from the initial visit to Alaska. Moreover, involving the community in the development of causal diagrams, such as the one presented in the health benefits section, gives them a sense of ownership and increases the buy-in for the project. The local partners also become aware early on of the potential risks and therefore will be encouraged to take an active role in the full implementation and monitoring of the project.

The third step, assessment, is the heart of the HIA. In this step, the baseline health and social conditions of the groups likely to be affected by the project are being described in detail. Moreover, in this step, the proposal is being assessed as to how it may affect those baseline conditions. Assessment requires a combination of qualitative and quantitative methods, as well as participation from community members to act as researchers alongside scientists who are usually hired as consultants. In this case, an unregulated entity, particularly an educational institution, will be able to provide the technical guidance in conducting a highly robust assessment of the potential impacts and risks of the project. This can also serve as an educational and capacity-building endeavor for local universities in Alaska as well as partner organizations from the community.

3 Gottlieb L, Egerter S, and Braveman P (2011). Health Impact Assessment: A Tool for Promoting Health in All Policies. USA: Robert Wood Johnson Foundation. Accessed from: http://www.rwjf.org/content/dam/farm/reports/issue_briefs/2011/rwjf70449

One issue that may arise is the degree of independence of the assessment team. To maintain independence and at the same time share technical expertise, the consortium of universities comprising the unregulated entity should send representatives who are not involved in the negotiations, planning, and implementation of the project itself – faculty members and researchers from schools of public health and environment for instance.

After assessing the situation, the HIA task force must develop practical recommendations to improve the health consequences of the project. This includes proposing measures to mitigate anticipated adverse health effects. This step is then followed by an open reporting and discussion of HIA findings and recommendations, especially the proposed mitigation measures, with decision-makers, community members and other stakeholders. Like the previous steps, these two steps – recommendation and reporting – have to be conducted with utmost transparency and inclusiveness in order to build trust among stakeholders in Alaska who will be involved and/or affected by the project.

The final step of the HIA process is monitoring and evaluation. To clarify, this is different from monitoring the future health impacts of the project. Instead, this step refers to evaluating the HIA process that was undertaken if it was done in accordance with practice standards and initial plan – this is referred to as process evaluation.

Furthermore, an outcome and impact evaluation of the HIA process can also be pursued later to assess the impact of the HIA process, its findings and recommendations on decision made during the project implementation process, as well as whether the HIA-predicted health effects matched the actual health effects. Given the continuous nature of monitoring and evaluation, the HIA multi-stakeholder task force will then need to remain functional during the entire duration of the project.

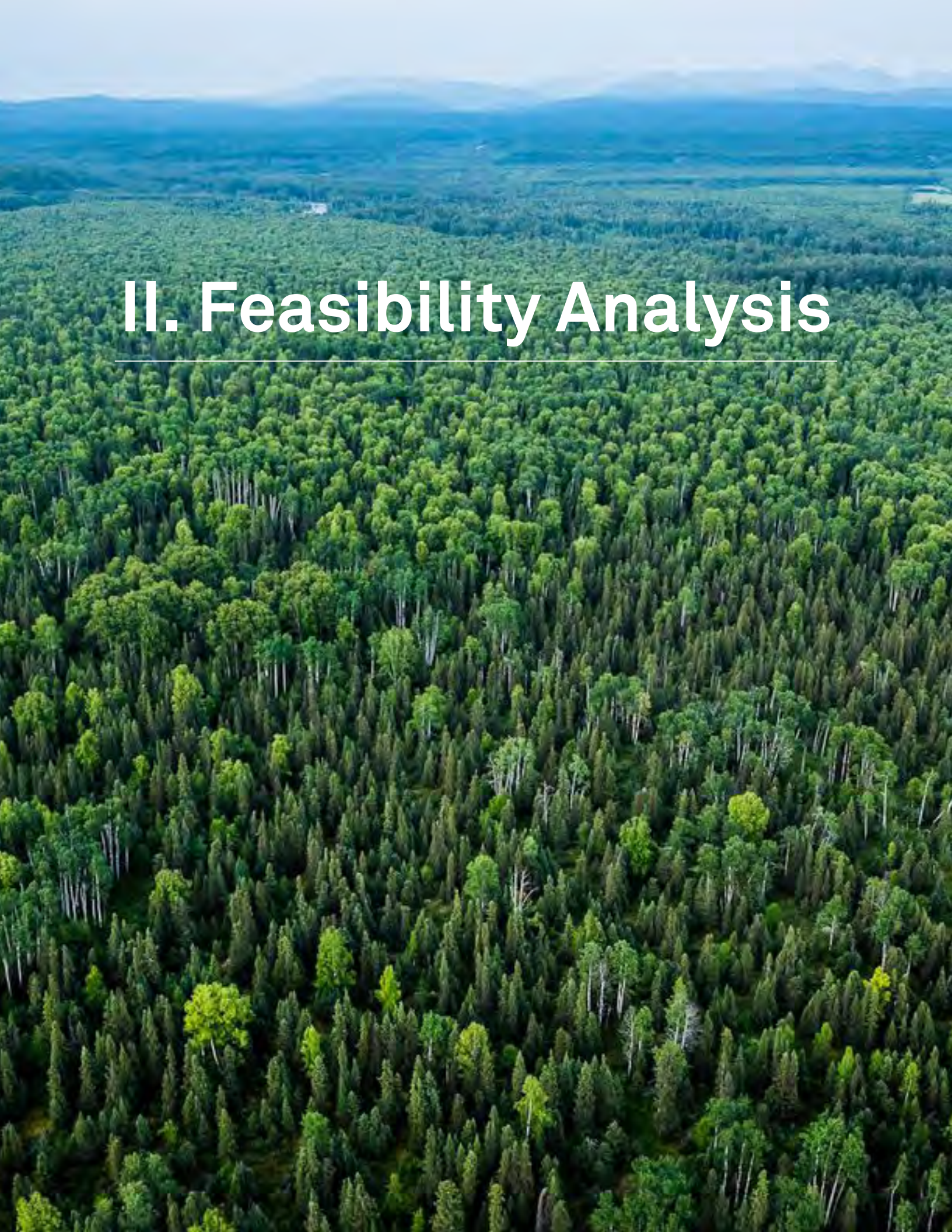
In addition to evaluating the HIA process, the health impacts of the project itself, while separate from project implementation, should be monitored over time to verify that the health benefits are real. This long-term monitoring that will span decades will have to be undertaken in several ways. First, the Alaska DHSS must establish robust disease surveillance systems to catch both acute and chronic health impacts that the project may bring about. Second, the unregulated entity, which is the consortium of universities, can turn the monitoring process into a longitudinal transdisciplinary research to investigate over time the health benefits and risks of forest management and weatherization. Moreover, given that the forest will be protected from destructive activities, this project presents an opportunity for the universities and communities alike to collaborate on research that examines forest ecology and health. This particular kind of research is very relevant today with the emergence of a new discipline called Planetary Health, which is defined by the medical journal The Lancet as "the health of the human civilization and the state of the natural systems on which it depends."[4]

4 Whitmee, S, Haines, A, Beyrer, C et al. Safeguarding human health in the Anthropocene epoch: report of The Rockefeller Foundation–Lancet commission on planetary health. *Lancet.* 2015; 386: 1973–2028.

APPENDIX E

FINANCIAL ANALYSIS

See attached excel tables.



II. Feasibility Analysis

Project Framing Statement

FEASIBILITY ANALYSIS

The Intergovernmental Panel on Climate Change (IPCC) has determined that the science behind global warming is unequivocal. The IPCC further found that anthropogenic emissions of greenhouse gasses, including CO2, is "extremely likely" to be the primary cause of the observed warming, which has impacted human and natural systems around the world. Although continued emissions will "increas[e] the likelihood of severe, pervasive, and irreversible impacts for people and ecosystems," substantial reductions in greenhouse gas emissions would help address climate change risks.[1]

Federal, state, and local governments have formulated and implemented a broad variety of policies in the effort to limit emissions, including the regulation of major sources of greenhouse gas emissions, such as power plants. Unregulated entities, such as major corporations and universities, have also made public commitments to voluntarily reduce their emissions. After implementing policies to reduce their carbon footprint within their existing properties and facilities, many unregulated entities have begun looking outward to reduce emissions off-site. "Unregulated entities" seeking to reduce their carbon footprint are the primary audience for this implementation proposal.[2]

This feasibility analysis is the result of an intensive course for graduate students, enrolled in a variety of Harvard graduate programs, led by Professor Wendy Jacobs, Director of the Emmett Environmental Law and Policy Clinic at Harvard Law School. Our interdisciplinary team focused on reducing an unregulated entity's climate impacts via an emissions reduction project in Alaska, with a goal of credibly and legitimately obtaining 50,000 metric tons of CO2 emissions offsets annually.[3] We sought projects that were additional, meaning they would not have occurred without the actions of the unregulated entity, as well as that would

1 IPCC, 2014: Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)]. IPCC, Geneva, Switzerland, 151 pp.

2 Language borrowed from Byers, Conleigh, Justin Galle, Jiahua Guo, Richie Schwartz, and Augusta Williams, Team IV Feasibility Report Draft, Climate Solutions Living Lab, March 2017.

3 Offsets are reductions in emissions in one place that can be used to compensate for emissions elsewhere, and are usually denominated in metric tons. Administrator. "Emissions Offsets." *LEED Certification - Leonardo Academy - The Sustainability Experts®*. Leonardo Academy, n.d. Web. 29 Mar. 2017.

maximize the emissions offsets that an unregulated entity could claim, minimize costs, and generate co-benefits for rural Alaska Native communities, including educational, environmental, cultural, and economic development benefits but most especially public health benefits.

In short, our goal is to examine projects that not only reduces CO2 emissions, but also benefit communities in rural Alaska. Ranging in population from 25 to 500 residents, the smallest villages are physically isolated and suffer high poverty and unemployment rates. This feasibility analysis followed an initial screening exercise, during which a number of potential projects were discarded due to insurmountable barriers to implementation.

Much of the information the team relied upon was specific to the Aleutian-Pribilof Islands and the Bristol Bay regions. These areas were the focus of workshops our student team attended in Anchorage during late February 2017, and most of the data and reports the team relied upon were drawn from these regions. The feasibility study is therefore largely based on assumptions about conditions in those areas of the country. While the general ideas are applicable to other remote regions of Alaska, many of the specifics, including payoff periods and baseline energy usage, vary by region. Renewable energy endowments, as well as forest carbon potential, are not uniform and any project that an unregulated entity chooses to pursue must be responsive to the geography and the partner community's needs.

Any project that an unregulated entity pursues must implement procedures that allow for robust community participation from the outset. The unregulated entity might with to develop principles including free and prior informed consent, data sharing, and a respect for privacy. Alaska is a diverse state, and a given community might include a federally recognized indian tribe, a Alaska Native Village Corporation, and a municipal government. Identifying key partners and allowing for the community to play a role in articulating its needs and sharing in any benefits is essential for success. Before commencing the project, the unregulated entity should consult with US government offices that regularly work with native communities such as the Bureau of Land Management, and consult with the Alaska Federation of Natives, the US Interagency Arctic Research Policy Committee and the National Science Foundation, and the Inuit Circumpolar Conference for further guidelines.

Key Findings

FEASIBILITY ANALYSIS

1. Rural Alaskan communities are an ideal target for equity-minded projects that reduce greenhouse gas (GHG)

Rural Alaskan communities are heavily dependent on burning fossil fuels for electricity and heating. Diesel and heating oil are burdensome for these low-income, rural communities. 20% of low-income households are energy burdened and spend 47% of their income on home heating, with electricity rates are as high as $1.00/kWh in communities with a diesel generator.[1] The intersection the cold climate, significant demand for home heating, and expensive electricity are one aspect of the complex environmental and energy justice rationale for pursuing GHG reducing projects here. While the small size and remote locations of these villages mean they are typically overlooked as project sites, there are numerous mechanisms, each with its own costs and benefits, to reduce GHG emissions, including: energy efficiency and weatherization, forest carbon sequestration, and renewable energy installations.

2. There is real demand for financing to support projects in rural Alaska

Weatherization, energy efficiency, and renewable energy projects were formerly financed primarily by Alaska state grants and Federal grants.[2] Both the Renewable Energy Grant Program and the Alaskan Power Project Loan Program, two major sources of funding, have ended, largely due to Alaska's current fiscal crisis caused by decreased tax revenue from low oil and gas prices.[3]

While there is still an assortment of Alaska Housing Finance Corporation (AHFC), Department of Energy (DOE), and Alaska Energy Authority (AEA) programs, they are not sufficient to meet the demand for renewable energy and energy efficiency projects in rural Alaska. Increasingly, communities are competing for limited capital to finance needed improvements to meet their

1 Cold Climate Research Center. *Small-Scale Biomass Combined Heat and Power Demonstration Project.* Fairbanks, AK: N.p., 2012. Online.

2 "Energy Efficiency Finance Seminar." Energy Efficiency Finance Seminar. Alaska Energy Authority, 2017. Web. 27 Mar. 2017.

3 "Renewable Energy Grant Program." Energy.gov. Department of Energy, n.d. Web. 27 Mar. 2017.

energy needs. This demand for capital in the form of debt and grants creates an opportunity for an unregulated entity to sponsor projects with creative financing mechanisms. Different projects are best suited for different unregulated entities, depending on the amount and type of financing the unregulated entity wishes to provide.

3. An unregulated entity can legitimately claim offsets by sponsoring projects

Many weatherization and other relevant projects have been designed, assessed, deemed technically feasible, and are ready for execution and implementation; however, without the financial sponsorship or support of an outside actor, i.e. an unregulated entity, these projects will not occur and the communities will continue to face the same high costs for diesel-based electricity.

Sponsoring one of the projects described will create additional emissions offsets that would not have occurred otherwise. Conversations with people "on the ground" in Alaska revealed that communities are concerned primarily with energy savings, not claiming and selling carbon offsets, so an unregulated entity can explore sponsoring a project in exchange for the carbon offsets.

4. An unregulated entity must consider all of the costs and benefits

The economic costs of sponsoring an emissions reduction project in Alaska will likely be higher than if the unregulated entity purchased offsets in the carbon market, particularly when considering the additional transaction costs of sponsoring a project.

However, an unregulated entity should look beyond the economic variables and consider the other benefits of sponsoring such projects in rural Alaska, which include: public health, educational, environmental, and economic benefits to the community, as well as distributional equity for traditionally marginalized, remote groups. By assigning value to these co-benefits, an unregulated entity can easily justify sponsoring projects to reduce greenhouse gas emissions. which will create additional benefits for marginalized populations.

5. Distributional Concerns v. Ease of Implementation

In general, an unregulated entity considering an offset project in Alaska must weigh distributional concerns on the one hand and the ease of implementation on the other. Projects that target the most isolated and smallest communities are typically more challenging and exhibit a high cost per offset.

On the other hand, large and easily implemented projects will tend to occur in larger communities where the population is better served. In resolving this tension, each unregulated entity should consider whether its mission or other goals more closely align with large offset projects with less measurable co-benefits or with costly projects that are responsive to equity concerns. Mixing and matching projects, as suggested in the attached implementation plan, might be a useful method for resolving this tension.

Screening Exercise

PRE-FEASIBILITY ANALYSIS

After an assortment of renewable energy, energy efficiency, weatherization, and other carbon offset projects were compiled, screening criteria were applied to prioritize a short list of options for further analysis. Screening criteria included: avoided CO2 , additionality, finance, legality, implementation, health benefits, other co-benefits, and scalability.

The results of the screening exercise were integrated village energy efficiencies (integration of weatherization and renewable energy) and forest management and sequestration.The entire screening exercise is included prior to this implementation plan.

Feasibility Analysis Summary Matrix

FEASIBILITY STUDY

	CRITERIA	PROJECT OPTIONS: WHOLE VILLAGE EFFICIENCY	FOREST SEQUESTRATION	RENEWABLE ENERGY PROJECT
ADDITIONALITY	TOTAL TONS OF OFFSETS	SOME RESERVATIONS	MOVE AHEAD	REAL DIFFICULTIES
	ADDITIONALITY	SOME RESERVATIONS	MOVE AHEAD	REAL DIFFICULTIES
	RISK OF ESTABLISHING CREDITS	SOME RESERVATIONS	REAL DIFFICULTIES	SOME RESERVATIONS
FINANCE	COSTS (UPFRONT CAPITAL; $ / OFFSET)	SOME RESERVATIONS	REAL DIFFICULTIES	REAL DIFFICULTIES
	SUBSIDIES	SOME RESERVATIONS	N/A	SOME RESERVATIONS
	TECHNOLOGICAL FEASIBILITY	MOVE AHEAD	REAL DIFFICULTIES	REAL DIFFICULTIES
LEGAL	PROCUREMENT AND TRANSACTION COSTS	REAL DIFFICULTIES	REAL DIFFICULTIES	MOVE AHEAD
	TAX INCENTIVES, CREDITS, LOANS	SOME RESERVATIONS	REAL DIFFICULTIES	REAL DIFFICULTIES
	CONTRACT ISSUES	REAL DIFFICULTIES	REAL DIFFICULTIES	REAL DIFFICULTIES
POLICY	GOVERNANCE COMPLEXITY	REAL DIFFICULTIES	MOVE AHEAD	REAL DIFFICULTIES
	ECONOMIC DEVELOPMENT POTENTIAL	REAL DIFFICULTIES	REAL DIFFICULTIES	REAL DIFFICULTIES
PLANNING & DESIGN	DISTRIBUTIONAL EQUITY	MOVE AHEAD	SOME RESERVATIONS	MOVE AHEAD
	SOCIAL CAPITAL	MOVE AHEAD	SOME RESERVATIONS	MOVE AHEAD
PUBLIC HEALTH	EDUCATIONAL BENEFITS	REAL DIFFICULTIES	REAL DIFFICULTIES	REAL DIFFICULTIES
	PUBLIC HEALTH BENEFITS	MOVE AHEAD	REAL DIFFICULTIES	REAL DIFFICULTIES

MOVE AHEAD · SOME RESERVATIONS · REAL DIFFICULTIES · INSURMOUNTABLE BARRIERS · N/A

Option 1: Whole Village Efficiency

FEASIBILITY ANALYSIS

PROJECT CONCEPT

- "CLAIM OFFSETS AS YOU GO" PROGRAM
- PROGRAM COMPONENTS ARE: 1) PUBLIC FACILITY WEATHERIZATION, 2) DIESEL POWERHOUSE UPGRADES, 3) HOME HEATING WITH SURPLUS ENERGY
- PROJECTS BUNDLED AT VILLAGE OR GROUP OF VILLAGES SCALES; GRADED GREEN, YELLOW, AND RED BASED ON FEASIBILITY CRITERIA
- UNREGULATED ENTITY SELECTS FROM DIFFERENT GRADES TO CREATE A PORTFOLIO THAT DELIVERS OFFSETS AS PROJECTS ARE COMPLETED

PROJECT ISSUES

Remote villages in Alaska primarily rely on diesel-generated electricity provided by locally-operated powerhouses. This system is problematic because of the volatility of diesel prices, the costs associated to delivering fuel shipments to remote locations, and the inefficiency of diesel engines In addition, 79% of rural households depend on diesel fuel for home- heating, which imposes heavy economic and health burdens on these families. The cost of home-heating makes many Alaskan households "energy burdened": in 2008, households earning less than 20% of area median income (AMI) spent 47% of income on heating.[1]

Addressing diesel at the household and village scales will reduce carbon emissions, but also result in health, economic development, and social benefits. Moreover, because a major share of village's resources are committed to energy production and heating, a whole village efficiency program represents a way to advance comprehensive community development.

Whole village energy efficiency has three scales:

1. Home Weatherization and Heating

Efficiency at the home scale includes: achieving the Alaska Housing Finance Corporation Building Energy Efficiency Standard (BEES)[2] for insulation and improving efficiency of home-heating, ideally by supplementing a diesel boiler with an electric air-source heat pump or a ceramic thermal storage unit. Heat pumps, however, are recommended only when the upstream electricity source is renewable.[3]

The development of multifamily housing or new housing prototypes, many of which are designed by the Cold Climate Housing Research Center in Fairbanks, can achieve greater energy efficiency through increased density of living space. Unfortunately, very little new housing is constructed each year in rural villages and it is not a viable solution at this time.

1 Cold Climate Research Center. *Small-Scale Biomass Combined Heat and Power Demonstration Project*. Fairbanks, AK: N.p., 2012. Online.

2 "For Professional Partners." *Alaska Housing Finance Corporation: Building Energy Efficiency Standard*. N.p., n.d. Web. 27 Mar. 2017. BEES is based on the 2012 International Energy Conservation Code (IECC), ASHRAE 62.2 2010, and the Alaska-specific amendments to both. Energy Star rating of 5 Star is required. BEES sets standards for R-Value, air and moisture barriers, and ventilation.

3 Cold Climate Housing Research Center, "Air Source Heat Pumps in Southeast Alaska," April 2013, 13.

2. Weatherization and Heating of Public and Commercial Facilities

Efficiency at the public facility scale includes: achieving the Alaska Housing Finance Corporation Building Energy Efficiency Standard (BEES) for insulation and improving efficiency of facility heating, ideally by replacing diesel boilers with biomass boilers and installing ceramic thermal storage units.

3. Diesel Powerhouse Conversion and Heat Recovery

Some Alaskan villages are dependent upon inefficient, dirty diesel powerhouses for electricity needs. The greenhouse gas emissions from such powerhouses can be reduced in a number of ways: installing a heat recovery system to produce hot water for heating public facilities and supplying hot water in public facilities, and creating hybrid- systems by installing solar, hydro, or wind capacity to reduce diesel use and lower the price of electricity provided. The introduction of hybrid systems also supports the creation of a distributed electric heating system in homes.

These three scales could be packaged for a single village or implemented across a grouping of villages to achieve economies of scale with respect to procurement and contracting. In addition, a community-based implementation process will maximize the social and economic benefits of whole village efficiency Such a process would respect and leverage existing forms of tribal leadership and community organization to create buy-in and to assure participation and long-term maintenance of renewable energy systems. The discrete work tasks could be funded through either a revolving loan fund that contracts with an ESCO or via a grant program.

Three key dynamics:

1. No One Size Fits All When It Comes to Villages

There are approximately 280 settlements in Alaska, ranging in size from major cities like Anchorage and Fairbanks to very small villages with few dozen residents. Though no official categorization exists, remote villages could be grouped into:[4]

1. Hubs – Population 4,000 to 5,000)
2. Sub-hubs – Population 500 – 1,000)
3. Villages – Population < 500

These village categories are further differentiated by the overall wealth of the community (income levels, community resources), and the form of governance (regional native corporation, village native corporation, etc.).

Because of these differences in size, economy, and governance, efficiency programs need to be tailored to each community – likewise, the achievable offsets will differ from community to community.

2. Need for Decoupling of Perverse Incentives

Two structural factors are barriers to implementing renewable energy programs at the village scale. The first is the basic supply and demand relationship between electricity use and price. If, for example, the powerhouse operator runs their system according to generally accepted utility-operator principles, an overall decline in electricity demand (due to more efficient housing) causes an increase in the price of electricity per kWh, as the utility has to recover the same fixed costs with a smaller

4 These categories extrapolated from Cold Climate Housing Research Center's "2009 Alaska Housing Assessment" (August 2009) and personal interviews with participants at the Alaska Energy Finance Seminar, BP Energy Center, Anchorage, AK, March 1, 2017.

customer load. One balancing act of any program, therefore, is to achieve reductions in use without increasing costs on residents or undercutting the financial viability of the powerhouse generator.

The second factor is the power cost equalization (PCE) program.[5] This program provides a subsidy to local utilities, according to a fairly complicated formula that involves bifurcating reimbursements for fixed and variable costs. PCE is intended to compensate for the high cost of diesel fuel in rural areas, as the railbelt, or most built-up section of the state, received significant public funding for electrical infrastructure.

The PCE subsidy can act as a disincentive for communities to reduce their usage of diesel fuel, as communities receive a smaller subsidy when they use less fuel. However, there are accounting methods through which sophisticated utilities can leverage the PCE subsidy to support the capital costs for renewable energy. The Alaska Energy Authority can provide details on these emerging methods through which utilities can turn the PCE from a disincentive for developing clean energy into a point of leverage.

3. Upstream Matters with Respect to Heating

With respect to household well-being, addressing the cost of home-heating and the energy burden is the most important factor to address.

If non-diesel, low-cost energy is available, a household switching to an electric air-source heat pump will reduce carbon emissions and cost by reducing diesel consumption at the household scale. However, doing so may not be the economically optimal solution if the powerhouse source is also diesel. If there is not a low- cost, renewable source, then electric heat – either through an heat pump or thermal storage – may in fact cost more for the household to purchase and may be less efficient as a result of efficiency at the diesel powerhouse and line-loss versus burning the fuel in a boiler at home.

The ideal solar-, hydro-, or wind-diesel system would create surplus energy that can be distributed to ceramic thermal storage units in homes or stored in lithium batteries.

EXISTING PROGRAMS

Since roughly 2008, several key state and federal programs have supported the three scales of whole village efficiency. According to the program manager of Renewable Energy Alaska, education and outreach about renewable energy has been widely implemented in Alaskan villages.[6] Many energy audits and feasibility studies have also been completed for public facility weatherization and local renewable energy generation.[7] A whole village efficiency program would build on these prior actions.

Individual House Efficiency

The Alaska Housing Finance Corporation has provided their weatherization services, such as insulation and installing more efficient appliances and lightbulbs, to most Alaskan households at 100% of area median income (AMI) and below.[8] This has been achieved through the Weatherization Assistance Program (WAP), which includes the state-funded programs Low-income

5 Brian Hirsch, "A Partial Solution to Rural Alaska Energy Challenges," *Alaska Dispatch*, October 24, 2015.

6 Personal Interview with Scott Waterman, Alaska Housing Finance Corporation, and Dustin Madden, Cold Climate Housing Research Center, at the Alaska Energy Finance Seminar, BP Energy Center, Anchorage, AK, March 1, 2017.

7 Alaska Native communities received energy audits as part of Phase 2 of the 2016 Federal RACEE Program. See: Energy Audits of Alaska, "Report on the Energy Audits and Energy Assessment Technical Assistance provided to the Native Village of Sand Point," June 6-10, 2016.

8 Personal Interview with Waterman and Madden.

Weatherization (Wx), the Home Energy Rebate (HER), and RurAL CAP Energy Wise.[9]

As of 2012, these programs had supported weatherization in 5,700 homes and 1,100 multifamily units through $171 million in funding.[10] However, according to an interview with a program manager at AHFC, since this data was published, the Weatherization Assistance Program was implemented in almost eligible households in Alaska, which in the last four years included HH up to 100% of AMI.[11]

This means that in many instances the first scale of whole village efficiency has already been accomplished. There are 307,000 houses in Alaska, and without as yet unpublished data, it is difficult to calculate the remaining opportunity.[12] In addition, a detailed assessment for each village would need to be completed to determine, on an house-by-house basic, what kinds of weatherization techniques have been implemented. For example, a comprehensive weatherization would address insulation in the foundation, walls, and roofs, the R-value of windows and doors, creating continuous air seals on all openings and the building envelope, the heating source, and ventilation.

Moreover, individual household assessments might uncover issues with the building – such as damaged foundations or beams or other structural framing that needs to be replaced – that ideally would be addressed alongside weatherization, even though this would increase the overall project cost. All of these factors make weatherization a very complicated and expensive strategy if the primary goal is the creation of carbon offsets. And, especially if the AHFC program has reached all houses under 100% AMI, there is less opportunity from a social equity perspective of

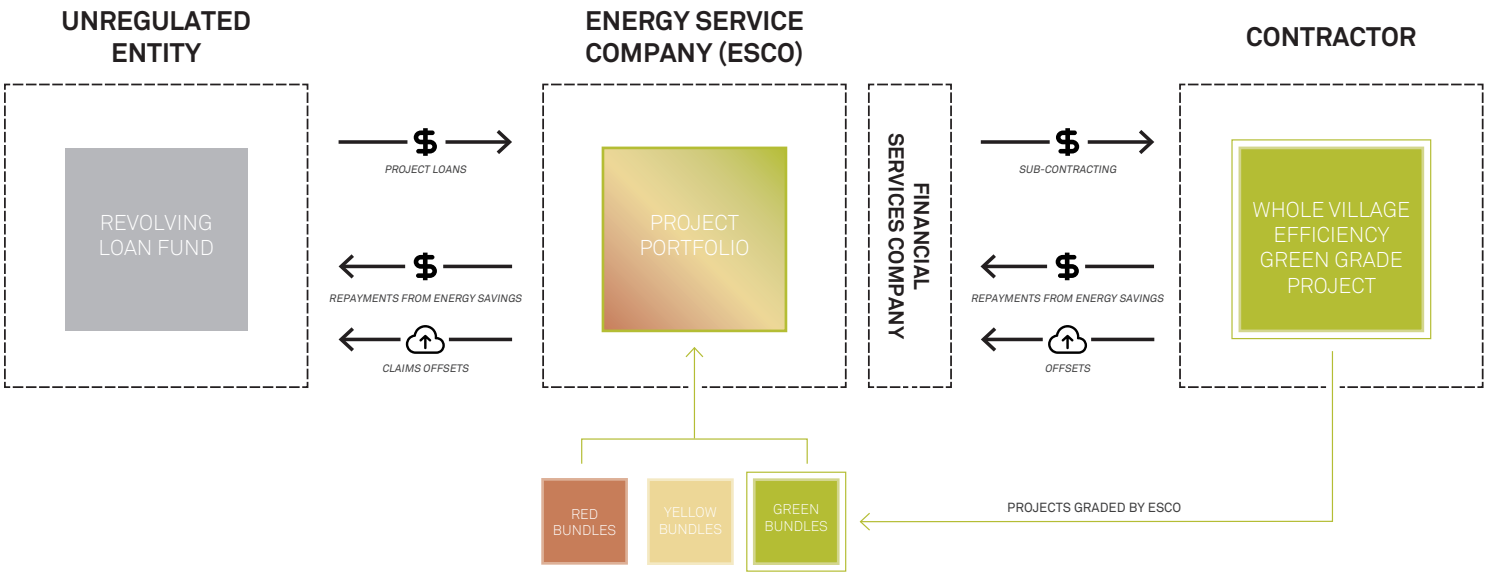
9 Information Insights, "Electrical Energy Efficiency, Environmental Scan: Barriers & Opportunities," October 7, 2011, 1.

10 Cold Climate Research Center. *Weatherization Assistance Program.* Fairbanks, AK: N.p., 2012. Online.

11 Cold Climate Housing Research Center, "Weatherization Assistance Program Outcomes," August 6, 2012, 2.

12 Cold Climate Research Center. 2009 Alaska Housing Assessment Part I and Part II. Fairbanks, AK: N.p., 2009. Online.

WHOLE VILLAGE EFFICIENCY PROGRAM DESIGN



addressing the energy burden.

Public Facilities and Commercial Buildings

There are three existing programs through the Department of Energy, Alaska Housing Finance Corporation, and Alaska Energy Authority that provide grants and loans to villages for weatherization of public facilities and private owners of commercial buildings. These programs have resulted during the last six years in 543 audits that could form a pipeline of potential weatherization projects.[13] The Alaska Native Tribal

13 Alaska Housing Finance Corporation and Cold Climate Housing Research Center, "Potential Paybacks from Retrofitting Alaska's Public Buildings," November 21, 2014, 1.

Financial Analysis

$2,820/ton for energy efficiency – $6,000+/ton for weatherization

Much of the basis of the opportunity for an unregulated entity to involve themselves as a financial sponsor in Alaska is based off the fact that grant funds are drying up. As such, the unregulated entity could simply provide a grant of $500k to finance some aspect of the whole weather efficiency in exchange for carbon offsets, with no expectation of financial return. Otherwise, the unregulated entity could act as a low-interest lender and help subsidize the debt financing to pay for these projects. Instead of demanding 5-8% interest to cover the typical cost of capital, a corporation could offer debt financing for 1.5-2.0% in exchange for carbon offsets. Through this mechanism, the unregulated entity may be willing to write a larger check (e.g. $3M-5M) than they would if it was simply a grant.

The costs will depend on the extent of the project and the target number of carbon offsets. Costs can be relatively small for purely residential weatherization: it would cost $7,500-$10,000 to weatherize a typical home,[1] based on meaning $750K-$1M for a village that had 100 homes. Here, the unregulated entity might contribute 50% of the capital required through the loan fund, the rest coming from a bank lending into the loan fund and Federal/State rebates for home improvements, which are made directly to the homeowner. Otherwise, an unregulated entity may sponsor a much larger, whole village efficiency project as described, costing closer to $3M-5M in up-front capital requirements.

Regardless of the amount of capital provided and the financing mechanism, the metric for comparison is $/carbon offset. In the Sand Point case study below, the cost for energy efficiency in was $2,820/ton and $6,000-8,000/ton for home weatherization (compared to $10-13/ton on a cap & trade market). Therefore, for an unregulated entity to justify the financial costs of either donating to or investing in whole village efficiency, they would have to quantify additional benefits such as public perception, improvements to public health, job creation, and economic development.

1 Cold Climate Housing Research Center, "Weatherization Assistance Program Outcomes," August 6, 2012, 2.

Health Consortium completed 60 audits in western Alaskan villages in 2011, AHFC did 327 audits with funding from the American Recovery and Reinvestment Act in 2011, and AHFC did another 156 audits of schools in 2012. There are 5,000 public buildings in Alaska, and the Cold Climate Housing Research Center estimates that $29 million is required to retrofit all of these.[14]

In addition to saved energy through weatherization, an important opportunity at the public facility scale is to connect heat recovery at the powerhouse scale to public buildings. In addition, weatherization of public facilities offers economic development opportunities because savings in public buildings operations can be reinvested in teachers and public programs.

Powerhouse Generation

Funding for wind-, solar-, and hydro-diesel systems was available until 2016 when state funding through the Alaska Energy Authority Renewable Energy Fund ended. In some cases, feasibility studies for heat-recovery and hybrid-systems have been completed. Like the audits of public facilities, these feasibility studies can form a pipeline of projects for whole village efficiency.

PROGRAM DESIGN: CLAIM-AS-YOU-GO PROGRAM

Whole village efficiency should target public facilities and powerhouse generation since the weatherization of houses for households with 100% of AMI and below are complete. As solar-, hydro-, and wind-diesel systems are installed, home heating – either with air-source heat pumps or ceramic thermal storage – can be improved.

The whole village efficiency program would have three components:

1. Public Facilities
2. Powerhouse Generation
3. Distributed Home Heating (including technology such as charging ceramic thermal storage bricks with off-peak renewable enargy or heat recovery at the powerhouse that distributes hot water to househollds for home radiant heating)

To maximize efficiency, cost effectiveness, and scalability, the components would be bundled within a village or grouping of villages, and these village projects would be graded as Green, Yellow, or Red based on criteria related to feasibility and implementation time.

The program would require a community-based project in the early phases and monitoring in late phases to measure actual emissions reductions. The unregulated entity would select from the Green, Yellow, and Red bundles to invest in, and claim offsets as projects are completed.

The community-process is key to creating long-term buy-in for the program, but also determining the grade of the bundle. Criteria that should be considered in the grading include:

- Are there existing audits or feasibility studies?
- What is the capacity of local governance and technical skill?
- How many projects can be bundled?
- How would distance and the short construction season govern implementation?
- How can local employment training be linked to procurement and contracting?

14 Alaska Housing Finance Corporation and Cold Climate Housing Research Center, “Energy Efficiency of Public Buildings in Alaska, Metrics and Analysis,” November 1, 2014, 5.

A Green grade would mean necessary components of a project are nearly ready for implementation; a Yellow grade would mean feasibility studies and bundling still need to occur; and Red grade would mean the technical and governance capacities of a community would need to be brought up in order to initiate feasibility studies.

Two key factors could influence the desirability of this program to an unregulated entity:

4. Drips versus Waterfalls: The Cost and Delivery of Offsets

There is no doubt on a dollar per metric tonne basis, offsets from a whole village efficiency program in Alaska will be more expensive than buying offsets on a market; the California Air and Resources Board is currently trading at about $13 per offset.

For example, taking the Weatherization Assistance Program as a whole and dividing total cash spent by total houses weatherized gives a result of $6,000 to $8,000 per metric tonne of carbon. (Cold Climate Housing Research Center, "Weatherization Assistance Program Outcomes," August 6, 2012) The social benefits, however, are harder to measure and may be an important consideration for the unregulated entity pursuing the project.

Moreover, the unregulated entity won't be able to claim the offsets all at once. Rather, the offsets will be claimed as Green, Yellow, and Red projects are completed, some of which will have large offset yields and others will have small yields.

In general, such a program would dteliver inconsistent offsets at a high cost, and it would be difficult for the unregulated entity to ensure that it acquires a certain number of offsets within a given period.

5. Factoring in Remoteness: Offset Accounting

Due to variability in energy audits and projected lifespans for various buildings, it is impossible to generalize about the emissions reductions achievable through a single building's weatherization. An unregulated entity that wished to claim ongoing offsets from a weatherization project would therefore have to ensure that the necessary auditing is performed.

This raises the cost per offset and makes scalability challenging. However, were an unregulated entity to consider the embodied energy of diesel fuel transported to remote Alaskan locations, increasing energy efficiency would generate significantly more offsets than reducing diesel usage in a more accessible location. Developing and employing a metric for embodied energy would mean that the more isolated the community, the greater the potential for offsets.

POTENTIAL BENEFITS

Whole village efficiency is not a home-run for offsets, but there is potential for strong social and economic benefits for village residents. If offsets are the primary goal, the unregulated entity needs to find value in supporting a package of interrelated benefits for the Alaskan communities. While some of those co-benefits must be qualitatively described, others might quantifiable and assigned dollar values:

- Environmental: Reducing diesel energy usage allows for better local air quality, potentially less sound pollution, and improvements to public spaces

- Economic: Construction and installation employment, operations and maintenance

employment, available public funds for hiring and programs

- Social: Increased governance capacity, lower utility costs, improved comfort in public spaces
- Health: Improve public health through reduced diesel pollution and stress from utility cost burden
- Health: Reduction in NOx, SOx, and PM 2.5 leading to reduced hospitalization rates

Legal Analysis

Contract mechanisms[1] will be critical to the success of a whole village efficiency project, particularly from the perspective of an unregulated entity. Putting aside the slew of subcontractors and outside lenders that might go into a particular project from the village's perspective, there are just two primary contracts that govern this arrangement: a master agreement (a tripartite contract between a bank, an ESCO, and the unregulated entity) and village-level agreements. This ignores the bidding process that the unregulated entity might wish to use in order to identify their ESCO partner.

This structure puts the technical onus on the ESCO, and can require the ESCO through contract to exploit all relevant loan and grant programs. The village submits the proposed work to the ESCO, which manages the bundles of village efficiency projects. See the contract issue analysis in Appendix A.

1 The Emmett Environmental Law and Policy Clinic at Harvard has already performed more specific analyses on contractual terms. The Clinic wrote a memo that addresses potential partners at the village level: the municipality, an Alaska Native Village Corporation, the utility, etc. Contact the Clinic for more information.

Additionality Analysis

Additionality depends on the design of the weatherization projects. As long as the project would have not been able to advance without the investment or involvement of the unregulated entity, the project should be additional.

To measure additionality, the Verified Carbon Standard (VCS) Weatherization of Single Family and Multi-Family Buildings Methodology[1] proposes a performance-based method to calculate the performance benchmark for each type of the project, and requires the offset project to achieve a higher level of performance than the

1 Verified Carbon Standard. "VCS Methodology VM0008 Weatherization of Single Family and Multi-Family Buildings." 2010.

Additionality Analysis

benchmark to achieve additionality. However, this method requires a relatively large sample size to calculate the performance benchmark, which is not applicable to Alaska since 1) the number of weatherized communities are relatively small; 2) each community, based on the housing conditions, would be implementing different weatherization projects, instead of a standard weatherization project. Therefore, in the case of Alaska, an unregulated entity should use a project-based additionality test.

The additionality test we propose includes the following:

- A mandatory regulatory test;
- A choice between an investment test and a barrier analysis; and,
- An optional common practice analysis.

The regulatory test requires that any emission reductions are below the level required by official policy, regulations, guidance, legal mandate, or industry standards, and the weatherization project is not built to comply with any current regulations or mandates. Since Alaska does not have carbon emission standards nor weatherization requirements, all of the weatherization projects will pass this test.

The investment test requires the project to be financially infeasible or unattractive without the carbon revenue or the involvement of the unregulated party, and/or capital or investment return constraints exist that can be overcome with carbon revenue. Therefore, these weatherization projects will pass the investment test if they would not have occurred without the involvement or investment from the unregulated entity.

The barrier test lists out a set of barriers that the project is currently facing, including financial barriers, technology barriers, policy or institutional barriers, organizational barriers, cultural or social barriers, etc. If any of the barriers are preventing the implementation of the current project, and the investment or the generation of carbon offset reduces or removes this barrier, then the project is additional.

Therefore, a currently running project or a project that is ready to start without barriers, would not be additional. The Additionality depends on the design of the weatherization projects. As long as the project would have not been able to advance without the investment or involvement of the unregulated entity, the project should be additional in terms of reduction of greenhouse gas emissions.

The common practice test ensures that the project is not a “common practice” in the sector or region, compared to the other energy efficiency projects. Since the Alaskan communities that need to receive weatherization projects have not received such modifications before, the project should be able to pass this test. However, as the weatherization project scales, the technology will become more common in Alaska in the long term. If this scenario happens, offset credits should be adjusted down due to the loss of additionality

Case Study

SAND POINT WEATHERIZATION PROGRAMS

Sand Point is located in the Eastern Aleutian islands about 550 miles from Anchorage.[1] The city has 976 residents (2010 U.S. Census) and 164 individual homes. Sand Point is characterized as a "prosperous" Village (personal interview at SWAMC conference). The median household income is $70,500; 41% of the population is low and moderate income, and there is 58% employment.

About six percent of all energy generated in the Aleutians is consumed in Sand Point. The village has already completed a wind-diesel project in 2012, and in 2016 Sand Point was one of 13 Alaska native communities audited under Phase 2 of Federal RACEE program. As of 2014, 33% of the residential housing in the village had been weatherized. The village therefore represents a program setting where there is capacity to implement renewable projects and potential to add to prior progress.

500 - 700 Tonnes of Avoided Carbon

As described in more detail below, current opportunities for whole village efficiency include:

- Weatherization of 13 public facilities following the 2016 audit; these projects would result in approximately 195 tonnes of avoided carbon emissions.

1 Information in this section from: Energy Audits of Alaska, "Report on the Energy Audits and Energy Assessment Technical Assistance provided to the Native Village of Sand Point," June 6-10, 2016.

SAND POINT

Case Study

SAND POINT WEATHERIZATION PROGRAMS

- Optimization[2] of the wind-diesel system to reduce line-loss and to utilize surplus wind energy for home heating with air source heat pumps or thermal storage units – eliminating line-loss[3] would result in about 150 tonnes of avoided emissions; completely replacing home diesel fuel heating with electric heat would result in 1 tonne of avoided emissions.

  Switching from home diesel heating systems to solar thermal storage means that instead of purchasing their own diesel for home heating, households would instead pay for wind-generated electricity from the local utility.

  The electricity, if purchased during off-peak hours, would cost less than diesel, thereby lowering home-heating expenses. (Even though that figure figure of 1 tonne of avoided emissions seems low, the economic benefit to residents would be dramatic since households spend 30 to 50 percent of income on home energy.)

- Weatherization of 66% of homes in community that were not weatherized as of 2014 would result in 350 tonnes of emissions (though more data is needed to determine the total remaining housing that has not been weatherized).

- There are other opportunities for heat recovery from waste water treatment and the powerhouse as well as the potential use of biomass boilers in public facilities, but more data is needed to determine potential offsets

Overall, these projects, if bundled, would result in about 500 tonnes of avoided carbon.

Costs and Project Complexity

Public Facilities

The cost of avoided carbon is high, though it does pay for itself through savings. The Phase 2 of Federal RACEE program audited 13 buildings in Sand Point, including the school, health clinic, municipal offices, recycling center, and community facilities. Across this inventory of buildings, there are six different owners: the Aleutian East Borough School District, Eastern Aleutian Tribes, City of Sand Point, Qagan Tayagungin Tribe, Aleutians East Borough, and Shumigan Corporation.

The audits specify efficiency improvements in four categories: lighting, envelope, HVAC, and other improvements such as boiler upgrades. The total cost of proposed improvements is $550,000, the proposed savings are $151,000, and the payback period is 3.6 years. (Energy Audits of Alaska, Report on the Energy Audits and Energy Assessment Technical Assistance Provided to the Native Village of Sand Point, June 6 – June 10, 2016)

2 Minimize line-loss while using the maximum amount of wind energy available from distributed home generation.

3 Line-loss: energy wasted during the transmission of electric power through power lines. These losses occur due to the conversion of electricity to heat and electromagnetic energy. (Energy Vortex.com)

Case Study

SAND POINT WEATHERIZATION PROGRAMS

The proposed improvements would save 162,600 kWh of energy and avert 19,352 gallons of diesel. Taking an emissions factor of 10.12 kg CO2 / gallon (EPA Emissions Factors, 2014), the improvements result in 195 tonnes of avoided carbon.

These are expensive offsets – the program costs $2,820 per avoided tonne of carbon. However, there are many other social and economic benefits – such as reduced heating costs – that are very important to households.

Powerhouse Optimization

Sand Point's powerhouse has been recently improved. The local utility is a subsidiary of TDX, which actually makes Sand Point an exception in that it is a village that doesn't own its utility. The system includes four Caterpillar diesel engines between 400 and 900 kW nameplate generating capacity of 2.6 MW. In addition, two wind-turbines were added in 2012, which brought diesel generation down by 15 percent. Currently, 5 percent line-lose amounts to about 154 tonnes of released carbon per year.

The regional energy plan includes recommendations for further optimizing Sand Point's energy and waste systems through heat recovery in the powerhouse and waste water treatment plant, capacity for wind-to-heat, and biomass boilers in public facilities.[4]

Home Weatherization

There are 164 homes in 2014, the majority of which were constructed in the 1970s and 1980s. As of 2014, 52 of these had been weatherized. These projects resulted in a reduction of 16,602 gallons of diesel, the equivalent of 168 tonnes of CO2.

In a best-case scenario, the remaining 66% of houses in Sand Point could be weatherized, which would result in another 350 to 400 tonnes of carbon avoided. In addition, the installation of air-sourced heat pumps or thermal storage units (using electricity from wind generation) could reduce diesel use at the household level for heating. Ninety percent of houses in Sand Point use diesel for heating (American Community Survey 2014), and the average home uses 75,000 Btus for home heating. (Aleutian & Pribilof Islands Regional Energy Plan Phase II: Report Update)

Taking an emissions factor of 73.96 kg CO2 / mmBtu of diesel, replacing all of the diesel fuel heating would result in about 0.9 tonnes of avoid carbon. This is a very low figure in terms of offsets, but much would be gained at the household level in terms of savings and improved environmental quality.

4 Southwest Alaska Municipal Conference, Aleutian & Pribilof Islands Regional Energy Plan Phase II – Report Update, December 2015.

Feasibility Analysis

WHOLE VILLAGE EFFICIENCY

TOTAL TONS OF OFFSETS

The longer time horizon, a “claim offsets as you go” approach, and the size of the villages make it very difficult to obtain 50,000 tons of emissions reduction offsets through village efficiencies. The Sand Point case study demonstrated a total carbon offset of 500-700 tons of CO2e. Therefore, reaching the 50,000 carbon offsets target would require scaling up to many villages, which is both expensive and logistically difficult.

ADDITIONALITY

Overall, additionality will depend on the design of the weatherization projects. Given the lack of carbon emission and weatherization standards in Alaska, a project and its corresponding emissions reductions will be considered additional as long as the project would have not been able to advance without the investment or involvement of the unregulated entity. However, as the weatherization project scales, the technology will become more common in Alaska in the long term. If this scenario happens, offset credits should be adjusted down due to the loss of additionality.

RISK OF ESTABLISHING CREDITS

Since the impact on energy usage from energy efficiency strategies is hard to measure, the amount of carbon offset to be claimed will be hard to determine. There is also a risk of permanence, since a weatherization project will require periodic maintenance and may be replaced by more advanced weatherization technology. Furthermore, there are risks from leakage in the form of replaced appliances continuing to be operated elsewhere, and from additional electricity usage from fossil fuels for electricity-based heating.

FINANCIAL COSTS

In terms of maximizing the reduction of greenhouse gas emissions to obtain carbon offsets, weatherization and energy efficiency is cost prohibitive. In the Sand Point case study, energy efficiency costs were $2,820/ton, and weatherization costs were $6,000+/ton.

SUBSIDIES

While public facilities are not eligible for PCE, the program acts as a disincentive for the home heating and the powerhouse upgrade components of this proposal. As less diesel fuel is consumed, fewer PCE credits are made available to the utility operator. The price that consumers pay will not accurately reflect the reduced diesel usage. This problem might be overcome in a number of different ways, all of which have their own challenges:

- Ensure the upgraded powerhouse generates energy at a price point lower than the old, subsidized cost of diesel minus PCE.

- Decouple PCE incentives through legislative or regulatory mechanisms.
- Upgrade the powerhouse through loans and other financial mechanisms which generate interest or other non-fuel costs that factor into the PCE calculation.

The second possibility should probably be avoided, as it would probably be unwise to direct legislative attention at the PCE program when the state is going through a fiscal crisis. The program is perceived as a ‘rural subsidy’ by many Alaskans who live in the Railbelt.

The third option requires careful cooperation with the Alaskan authorities and the communities served, to make sure they receive the expected PCE after completion of the powerhouse upgrade. The first option is perhaps the most straightforward, but also creates a high bar for potential upgrade projects.

TECHNICAL BARRIERS

Whole village efficiency initiatives are relatively simple and effective means of reducing carbon emissions. The science and technology required to implement these measures is well-understood and there is not a high risk of failure due to technical risks. The cost savings from these measures is intuitive and simple to understand, e.g. motion-detectors and LED lighting require less electricity; better insulation means less heat loss for a home. For many communities, audits of public buildings and residential homes have already been conducted with thorough plans for energy efficiency and weatherization projects.

PROCUREMENT AND TRANSACTION COSTS

Since procurement law varies according to municipality, it might prove difficult to bundle different communities and expect the same contractual arrangements to comply with the relevant requirements. Generally speaking, most municipalities require competitive bidding for projects above a certain cost. If the projects are below that floor, then the contractor is unlikely to run into problems. If the same energy services company handles all of the bundled, village-level projects, it might run into some problems with competitive bidding. On the other hand, it may well be that there is no significant competition, and thus the procurement requirement might be satisfied easily. An alternative option is for the community to waive any procurement requirements in exchange for a guarantee of subcontracting with competent locals to perform the discrete tasks which comprise the overall village efficiency project.[1]

An unregulated entity will incur costs related to conducting due diligence to ensure the technical/economic/regulatory viability of a project. Costs will also vary based on the complexity of the financing mechanism. Providing a grant should be relatively simple, but providing debt financing through a revolving loan fund will require considerable legal and accounting expertise (and expense) in order to establish a contracting mechanism.

1 Personal Interview with Gary Hennigh, representative of King Cove, at the Alaska Energy Finance Seminar, BP Energy Center, Anchorage, AK, March 1, 2017.

TAX INCENTIVES, CREDITS & LOANS

Firstly, for the community power station upgrades, all tax incentives and credits identified in the Renewable Energy Project proposal are applicable. Generally speaking, given the recent status of the Alaska state budget, tax incentives and credits tend to be from federal sources. While Alaska used to have a Renewable Energy Grant Program, it no longer provides grant. On paper, there remains an Alaskan Power Project Loan Program for hydro and wind projects, but it is unclear how much in loans is available through that program. Any project that an unregulated entity pursues with an Alaskan town should make full use of any applicable grants and loans from the federal government. If the federal support and private loans do not cover the cost of the project, the unregulated entity might step in to make up the difference, in exchange for offset credits.

However, since there are more component pieces to the village efficiency proposal than the renewable energy project, additional incentives and loan programs might be available. If the unregulated entity partnered with a regional tribal corporation, that corporation might be eligible for QECBs, which are low interest bonds similar to CREBs. For the home heating component of a village efficiency project, a number of Alaska Housing Finance Corporation (AHFC) programs might apply. Individuals can take out low-interest small building material loans from AHFC.

If the homeowner did not already benefit from the Weatherization Assistance Program, they may be eligible for up to a $10,000 rebate through AHFC's Home Energy Rebate Program. For the public facility weatherization component, the AHFC operates an energy efficiency revolving loan fund. The current status of these AHFC projects are unknown. Given the complexity of credit, loan, and other incentive programs that might apply to each component of a village efficiency project, either the contractor or the community itself should be primarily responsible for identifying such programs, rather than the unregulated entity.

CONTRACT ISSUES

SEE APPENDIX A

Given the complex relationship between multiple entities (ESCO, unregulated entity, bank, revolving loan fund, village), an unregulated entity must ensure that there is a clear contract mechanism in place beforehand. This contract mechanism will be critical to ensuring that the ESCO is responsible for actually performing the work and that the unregulated entity can legitimately claim any offset credits.

GOVERNANCE COMPLEXITY

Governance complexity will be a concern with the unregulated entity will join a group of investors to establish either a revolving loan fund or a grant program, a bank that manages the fund and collects a service fee, and either an ESCO or villagers themselves who access the fund. Managing the distribution of funds to plan projects and ensure that funds are repaid to debt investors and that the unregulated entity receives offset credits requires considerable management effort on the part of multiple stakeholders and clear contracting mechanisms.

ECONOMIC DEVELOPMENT POTENTIAL

There are training and job opportunities for village residents in the whole village efficiency project. Residents could be trained on the operations and maintenance of district heating, installation of heating stones, and battery storage. While the training opportunities are easy to guarantee, the consistency of the jobs is harder to determine, since ideally the interventions require little time and money in terms of operations and maintenance, and the installation does not provide an indefinite employment opportunity.

However, given the limited employment opportunities and relatively low income, any amount of job creation has the added benefit of a multiplier effect since that employee can then buy goods and services within the community.

DISTRIBUTIONAL EQUITY

Whole village efficiency is excellent in terms of distributional equity considerations, since village efficiency offers a strong opportunity for increasing social capital. Furthermore, given that these villages are typically ignored or passed over from targeted programming due to their small scale, distributional equity is a particularly important objective of whole village efficiency.

SOCIAL EMPOWERMENT

Village efficiencies offer a clear and effective approach for increasing social empowerment and capital in a community. Energy savings could be used to expand village programming, increase educational or job opportunities, and assist with other needs within the community. Additionally, improved district heating techniques could also improve comfort within public buildings and provide greater satisfaction for community members using the facilities. Easing the community's concerns about energy costs will relieve an enormous burden and improve quality of life in the village.

PUBLIC HEALTH BENEFITS

Improving efficiency in an entire village can offer a variety of health benefits for different members of the community. Occupants of houses that undergo weatherization and heating system upgrades will live in drier homes with more consistent temperatures, fewer air indoor pollutants, reduced allergens, and fewer asthma triggers.[1] The same benefits can be enjoyed by community members utilizing public and commercial buildings that will be retrofitted as part of this whole village efficiency project.

wFurthermore, reducing diesel burning in converted powerhouses will lower the amount of noxious pollutants in the atmosphere such as particulate matter (PM 2.5), nitrous oxide (NOx) and sulfur dioxide (SO2), which in turn will result in improved cardiovascular and respiratory health for members of the surrounding community.[2]

1 E4 The Future (November 2016). Occupant Health Benefits of Residential Energy Efficiency. Available from: https://e4thefuture.org/wp-content/uploads/2016/11/Occupant-Health-Benefits-Residential-EE.pdf.

2 Office of Environmental Health Hazard Assessment (OEHHA), California Environmental Protection Agency (CalEPA) (2001). Health Effects of Diesel Exhaust. Available from: https://oehha.ca.gov/air/health-effects-diesel-exhaust.

EDUCATIONAL BENEFITS

Community members will learn about the importance of protecting the environment, addressing climate change, conserving energy, and improving health and wellbeing. Residents, and most especially those who will be employed in this program, will also acquire new technical skills that are essential for installation and maintenance of weatherization measures. Money saved from reduced fossil fuel burning as a result of more energy-efficient homes and buildings can instead be invested in educational programs, particularly in maintaining schools that may be on the brink of closure.

Option 2: Forest Sequestration

FEASIBILITY ANALYSIS

PROJECT CONCEPT

- THE UNREGULATED ENTITY PARTNERS WITH AN ALASKA NATIVE REGIONAL OR VILLAGE CORPORATION ON A FOREST CARBON PROJECT, ACHIEVING CARBON SEQUESTRATION THROUGH IMPROVED FORESTRY MANAGEMENT, REFORESTATION, AND AFFORESTATION

- THE UNREGULATED ENTITY AND THE NATIVE CORPORATION ENGAGE A CARBON PROJECT DEVELOPER WHO MANAGES THE PROCESS AND PAYS THEMSELVES WITH A PERCENTAGE OF THE GENERATED OFFSETS, WHILE THE UNREGULATED ENTITY PAYS THE NATIVE CORPORATION FOR THE REMAINING OFFSETS

- THE PROJECT CAN BE SCALED ACCORDING TO THE DESIRED NUMBER OF OFFSETS

BACKGROUND

Alaska Native Claims Settlement Act (ANCSA) is a federal law that permitted the conveyance of about 45 million acres of land to Alaska Native regional and village corporations, and the transfer of about one billion dollars in exchange for the extinguishment of native land claims (with some minor exceptions). (See Appendix B)

The regional and village corporations are for-profit entities that served as vehicles for distributing the settlement to eligible native shareholders. The regional and village corporations are distinct from tribal governments recognized by the federal government. Regional corporations possess subsidiaries and are often large, diverse businesses with significant revenue, often from resource extraction.[1]

While native corporations are for-profit entities, under ANCSA, corporations may provide benefits that promote the health, education, or welfare of shareholders and other Alaska natives, and their articles of incorporation, filed with the state of Alaska, establish their intent to provide such benefits. Examples of these benefits include building a wind turbine, distributing firewood, and managing property leases and easements.[2] However, many corporations indicate that subsistence use is their primary or highest-priority use of the land. That is, most corporations are committed to ensuring that their members can use the lands for hunting, camping, timber, etc.[3]

While ANCSA imposes no restrictions on the conveyance of property rights, forest carbon projects on Alaska Native lands are only a recent development. Thus far, only a couple transactions have closed, including the Chugach carbon deal, which serves as an illustrative example in this report.

PROGRAM DESIGN

An unregulated entity could partner with a native corporation partner on a wide variety of potential forest carbon projects, including the following:

- Partner with a Native regional or Native village corporation.

1 Case, David S., and David A. Voluck. *Alaska Natives and American Laws*. Fairbanks, AK: U of Alaska, 2012. Print.

2 Cohen, Felix S., and Nell Jessup. Newton. *Cohen's Handbook of Federal Indian Law*. New Providence, NJ: LexisNexis, 2012. Print.

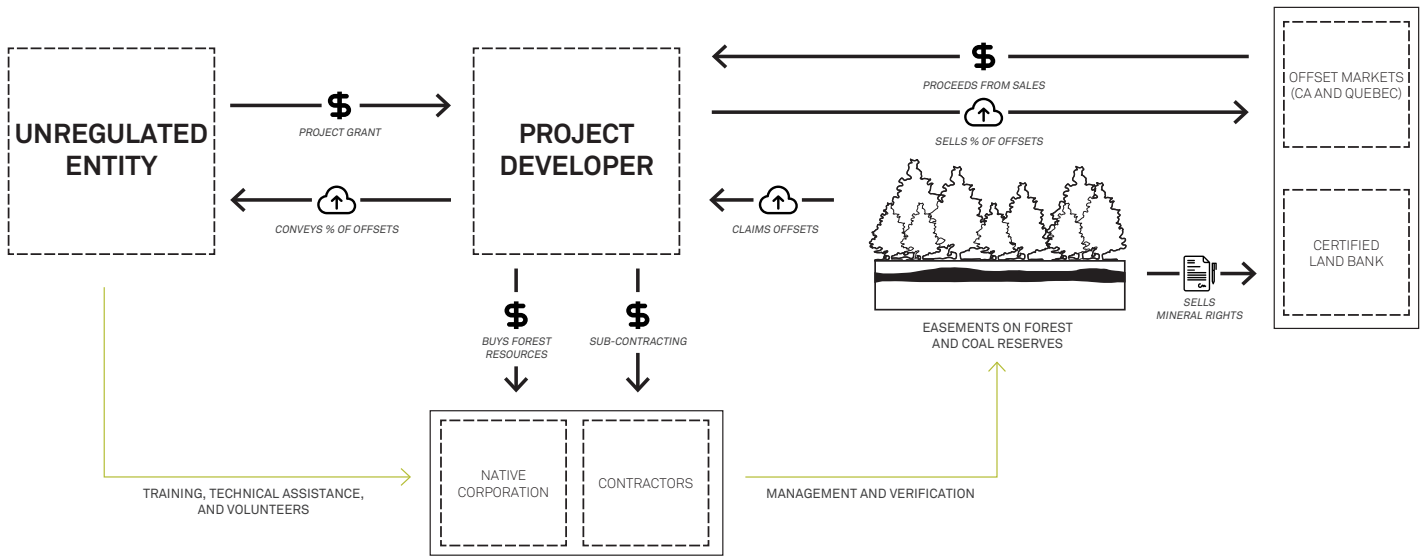
3 Personal Interview with Josie Hickel, SVP Energy & Resources for the Chugach Alaska Corporation at the Chugach Headquarters, Anchorage, AK, February 28, 2017.

- Engage in a “Reforestation”, “avoided conversion”, or “Improved Forest Management” project.
- Reforestation allows offset credits for tree planting.
- Avoided Conversion generates offset credits based on permanent conservation easements that avert the conversion of a forest to non-forest.
- Improved Forest Management projects generate offsets in exchange for changes in management that sequester additional carbon.
- Sell offsets on a voluntary market or compliance carbon market, such as the California Air Resources Board compliance market.
- Hold the offsets and retire them without selling on the market.
- Arrange a forest management plan without the coal development rights.
- Bundle villages together to arrange a management plan on a larger area of land.
- Arrange a consortium of unregulated entities to spread the costs and benefits of the project.

An unregulated entity could arrange an improved forest management project with an Alaska Native Village Corporation. The unregulated entity would engage a forest carbon project developer with experience working on such projects in the region to perform the training and educational aspects that go into forest management, as well as the verification and carbon market certification processes.[4]

4 Full details of the CA Air Resources Board’s Compliance Offset Protocol for U.S. Forest Projects may be found here: https://www.arb.ca.gov/regact/2014/capandtrade14/ctusforestprojectsprotocol.pdf. Note that this publication predates the recent shift that removed the Alaska forest exemption, which the Chugach deal allowed for.

FOREST SEQUESTRATION PROGRAM DESIGN



If aligned with the California Air Resources Board compliance market requirements, the project developer would be able to pay themselves for their services with a percentage of the generated offsets. Compliance markets require that forest carbon projects comply with strict protocols, calling for audits, inventories, and regular verification. The unregulated entity would pay the Native corporation a pre-determined price, perhaps tagged to the carbon market, and set aside money into a trust that would be accessible in order to finance the audits and inventories into the future.

Finding the right partner is vital to the success of a forest carbon project, and the unregulated entity should acquire a detailed map of surface and subsurface land ownership, as well as information from the Forest Service Inventory. While a project with a corporation outside of Kodiak, Chugach, and Sealaska is possible, those forests contain less carbon and have a higher likelihood of forest fire (and are currently outside of the geographical scope of the California Air Resources Board offset market). Village representatives, such as one from Kodiak, have expressed interest in pursuing deals similar to the Chugach one.[5]

The exact number of offsets generated by such a project cannot be determined ahead of time, but one can make rough estimates based on comparable projects on similar forests. An improved forest management project on Chugach lands (a Alaska Native Regional Corporation) generated approximately 40 credits per acre of forest.[6] If an unregulated entity arranged for a forest management program on about 1,600 acres of of similarly dense forest, that agreement would generate 50,000 carbon offsets and include an additionality and leakage buffer.

The land holdings of native village corporations varies, and the final implementation plan found after this report, delves into the details and holdings of a particular native village corporation. Those offsets would be worth approximately $625,000 on the California compliance market,[7] but significant transaction costs would be required to ensure those credits meet California standards.

POTENTIAL BENEFITS

- Ability to scale the project to the targeted number of carbon offsets based on acreage.
- Securing lands for subsistence for Alaska Natives.
- Providing financial stability for a Native corporation.
- Skills training and employment for Native villagers.
- Relative certainty of additionality in terms of carbon sequestration.

5 Personal Interview with Josie Hickel, SVP Energy & Resources for the Chugach Alaska Corporation at the Chugach Headquarters, Anchorage, AK, February 28, 2017.

6 Personal Interviews with Josie Hickel, SVP Energy & Resources for the Chugach Alaska Corporation, and David Phillips, Land Manager, at the Chugach Headquarters, Anchorage, AK, February 28, 2017.

7 "California Carbon Dashboard." *California Carbon Dashboard: Carbon Prices, the Latest News, and California Policy*. California Air Resources Board, 2017. Web. 27 Mar. 2017.

Financial Analysis

An unregulated entity seeking to reduce its carbon footprint could simply purchase carbon offsets at the market rate in a regulated market. Specifically, for a target of 50,000 tons of CO2 reductions, an unregulated entity could go to the California Cap & Trade market and purchase 50,000 tons of offset credits at ~$13/ton,[1] for a total price of $650,000. Since Alaska has no regulation imposing an emissions trading scheme, there is no regulation-initiated demand for carbon offsets from Alaska.

As such, the cost of carbon offset in Alaska may be less than $13/ton, since this price include not only the cost of reducing one ton of CO2 emissions (through better forest management for instance), but also the costs of compliance and verification to ensure that those offsets meet the threshold of additionality. In other markets, carbon offsets are trading for slightly less - around $10/offset in Western Climate Initiative market and $5/offset in Regional Greenhouse Gas Initiative market, albeit with different requirements for verification and compliance standards.

Based on this rate, an unregulated entity should pay no more than $500k-650k to sponsor a forest management program, avoided conversion, or reforestation program in order to obtain and retire the 50,000 tons of emissions reductions.

This price is inclusive of all other costs - creating a legal framework and hiring a carbon project developer to actually go out and survey the land, conduct initial and periodic audits and measurements (as mandated by the California Air Resources Board (CARB)), etc. to ensure that the amount of forest land actually converts to the required storage of CO2. The challenge is that the costs of a carbon project do not scale down as well with a smaller area of forest, namely 1,250 acres of forest rather than 110,000 acres of forest.

With the benchmark of $650k, that only leaves about $150,000 to pay a Native village corporation in exchange for protecting the 1,250 acres of required forest, which is up to $120/acre. The unregulated entity must be able to show the Native corporation that the benefits of conserving the 1,250 acres of forest are what is best for the Native people, for example in terms of ensuring the land is available for subsistence.

1 The spot carbon price in the California Cap & Trade market as of April 25, 2017. Accessed from http://calcarbondash.org

Legal Analysis

As with other projects, a strong contract mechanism established up-front is critical for the legal foundation of such a deal. The parties to the contract include:

1. The unregulated entity;

2. The Alaska Native Village Corporation(s) (or regional corporation on behalf of Village(s));

3. The carbon project developer (or contractors regularly employed by known project developers); and,

4. A certified Land Bank.

If there are minerals under the forest, then the right to develop such minerals should be conveyed to a certified land bank,[1] to ensure that such rights are not available to a creditor in the case of corporate insolvency.[2] Since regional corporations are more likely to hold subsurface rights, such an arrangement might require a contract with the regional corporation.

Under the proposed contract mechanism, the unregulated entity enters into a multilateral contract with the Native Village Corporation and with the carbon project developer.

Key terms include:

- Express the purpose of the contract: to secure land for subsistence and other benefits while generating carbon offsets.

- A representation from the project developer and Native Village Corporation that but for the guaranteed purchase from the unregulated entity, such a project would not occur.

- Arrange for the conveyance of a mandatory minimum of offsets to the unregulated entity, guaranteeing the unregulated entity retain exclusive ownership of a percentage of the total offsets.

- Warranty from the project developer that they will perform all relevant record-keeping, baseline setting, verification, and audits in conformity with the relevant protocol. If that protocol requires third party verification, then the contract should identify a relevant third party and the carbon project developer should provide an indemnity.

- The project developer or the unregulated entity covenant with the corporation to subcontract with qualified Native Corporation shareholders for the performance of verification and auditing.

Legal Risks

- The innovativeness of the carbon deal created a question about the applicability of the ANCSA

1 Rand Hagenstein, Alaska State Director of the Nature Conservancy, emphasized the importance of this measure during a personal interview on February 28, 2017 at the Nature Conservancy offices in Anchorage, AK.

2 Cohen, Felix S., and Nell Jessup. Newton. Cohen's Handbook of Federal Indian Law. New Providence, NJ: LexisNexis, 2012. Print.

Legal Analysis

7(i) provision. If the carbon deal is a “timber development” under 7(i), and the unregulated entity partnered with a regional corporation, then the revenue generated would be subject to revenue sharing.

The 12 regional corporations are in discussions over whether such projects qualify but have not yet reached a consensus (nor, as of March 2017, has the discussion moved to the point of arbitration). If the deal does fall under 7(i), the long tail costs might limit such projects from happening on the regional level, as the large, up front revenue would be shared but the costs over time would be borne by a single corporation.

- For transactions dependent upon the California compliance market, there are murmurs of changes in the protocols that might exclude improved forest management projects. Some expect an upcoming battle over this i

Additionality Analysis

There are multiple protocols that the project can follow to create legitimate and credible carbon offset credits from forest projects, including the Verified Carbon Standard (VCS) Agriculture, Forestry and Other Land Use (AFOLU) Requirements,[1] California Air Resources Board (CARB) Compliance Offset Protocol,[2] etc.

Each protocol has a set of eligible carbon offset projects. The AFOLU Requirements listed Afforestation, Reforestation and Revegetation (ARR), Agricultural Land Management (ALM), Improved Forest Management (IFM), Reduced Emissions from Deforestation and Degradation (REDD), Avoided Conversion of Grasslands and Shrublands (ACoGS), whereas the CARB protocol included only three categories: Reforestation, Improved Forest Management and Avoided Conversion.

As for specific project requirements, the CARB Protocol includes requirements on location, verification, additionality, permanence, and monitoring. For additionality, the Protocol specified two additionality tests: regulatory test and performance standard test, which are used to determine the additionality of each project. The VCS Protocol, on the other hand, sets up requirements for start date, crediting period, location, participation, leakage management, permanence, boundary and monitoring methodologies.

One policy risk stems from the permanence issue, which means the life of the carbon offset project has to be long enough to ensure long term carbon emission reduction. Climate change effect would not have been mitigated if the forest is only conserved for one year and to be clear cut the next; the CARB market requires that the project exists for 100 years.

Permanence will depend on the length of the contract, the forest management requirements as well as financial viability and policy environment. Leakage, another policy risk, occurs when emission avoided within the project are displaced to another location or time, or when the offset project leads to forest clearing elsewhere. In a forest management project, leakage risks occur when the forests nearby or owned by the same entity are being cut down as a result of this project.

To prevent these circumstances from occurring, the project developers need to conduct surveys and product reports to monitor and report the level of carbon emission reductions achieved as the result of this project, establish buffer zones to make up for underperformance, and include contract terms that restrict potential unsustainable forest management elsewhere.

1 Verified Carbon Standard. “Agriculture, Forestry and Other Land Use (AFOLU) Requirements.” 2013. Version 3.

2 California Air Resources Board. “Compliance Offset Protocol. U.S. Forest Projects.” California Environmental Protection Agency. 2015.

Case Study

CHUGACH CARBON CREDIT DEAL

The Chugach Alaska Corporation (a regional corporation) closed an "improved forest management project" or "carbon deal"[1] with New Forests, a California project developer.[2] New Forests converted some 110,000 acres of forest into four to five million carbon offset credits to be sold on the California cap/trade compliance market.

New Forests transmitted most of those credits back to the Chugach Corporation, while keeping a share of those credits as its fee (between 9% and 25%). About half the acreage of the forest overlies a large coal deposit, which was conveyed to the Chugach under ANCSA in 1983. New Forests assigned the coal development rights to the Nature

1 This case study is based upon personal interviews with Josie Hickel, SVP Energy & Resources for the Chugach Alaska Corporation, and David Phillips, Land Manager, at the Chugach Headquarters, Anchorage, AK, February 28, 2017; personal interview with Rand Hagenstein, Alaska State Director of the Nature Conservancy, Anchorage, AK, February 28, 2017; and email correspondence with Brian Shillinglaw, the leader of New Forests' US timberland and environmental market investment strategies during February and March 2017.

2 The California Air Resources Board manages the market. Initially, there was an exclusion for Alaska but the players in this carbon deal managed to negotiate the removal of that barrier. It is possible the CA Air Resources Board has only removed the exclusion for portions of Alaska's forests.

CHUGACH FOREST

Case Study

CHUGACH CARBON CREDIT DEAL

Conservancy for a nominal rate to retire. The Nature Conservancy treats the coal rights as a preserve. To ensure the coal is not developed, were the Nature Conservancy to become insolvent, they arranged an equitable servitude with the Native Conservancy Land Trust.[3]

Project Structure and Motivations

The carbon deal required New Forest engage Chugach shareholders in the carbon audits and train them for a handoff of forest management after 5 years. The carbon deal locks up the land for 100 years and allows the Chugach to take a net operating loss as a tax reduction on the decreased value of the coal development rights.

According to corporate leadership, maintaining the ability of their shareholders to engage in traditional subsistence lifestyles was a major consideration for the Chugach corporation.[4] The lands were originally selected by the corporation for economic development opportunities, but the carbon offsets, combined with the co-benefits (training and securing subsistence), and tax write-off on the coal made the carbon deal attractive.

The Chugach already had forest inventory data from a prior, US Forest Service project.[5] Another motivation was the area that the carbon deal covered included lands hit hard by the Exxon Valdez spill, and the carbon deal was perceived as a way to protect future subsistence. The Corporation considered it a low risk that a shareholder might sue them for the decision. Although the coal development rights and the carbon deal are on the same tract of land, the Chugach retained all the land rights other than the coal development rights. The Corporation could still build an ecotourism project or even mine for gold.

New Forests performs a forest inventory, and verifies that inventory with a third party. The carbon deal required New Forests to hire shareholders for jobs/logistics associated with the inventory and verification and then worked with the California Air Resources Board to log the project. The sale of Chugach's offsets on the compliance market will generate a large pay-out and then, over time, the Chugach will be able to sell additional forest growth (certified by inventory/verification). While initially highly volatile, the California compliance market has settled for the last couple years and currently pays out about $12-13 per offset.

Those later paybacks are likely to be small, and

3 New Forests proposed this arrangement. Since subsurface rights are superior to surface rights, securing the coal development rights provided greater stability to New Forests' stake in the carbon deal. Further assurance could have been provided with an equitable servitude to a registered 501(c)(3) Land Trust in the Land Trust Alliance, which requires meeting certain standards and certifications.

4 This section is based on conversations with Josie Hickel, Senior Vice President of the Chugach Alaska Corporation and Dave Phillips, Land Manager.

5 The Forest Inventory Assessment data is available for lands in various parts of the state through the Northwest Research Station Inventories.

Case Study

CHUGACH CARBON CREDIT DEAL

the regular inventories required by the compliance market create long tail costs for the Chugach. The Chugach mitigate the risk of forest fire and windstorms with certain techniques but did not buy insurance to manage that risk. The Chugach could buy their way out of the 100-year California cap/trade commitment, but such a reversal would be expensive.

In addition to supporting the subsistence lifestyle,[6] the carbon deal was motivated by other co-benefits as well. There is a hope that when projects occur near villages, such activity might prevent an exodus out of town. The carbon deal creates the possibility for repeated, short-term future jobs for shareholders. It is consistent with general corporate values of maintaining opportunities on the land and bolstering long-term sustainability.

6 The Chugach are cognizant of the fact that certain aspects of the subsistence lifestyle generate their own health risks. For example, burning firewood for heating in closed spaces creates health and safety risks.

Feasibility Analysis

FOREST SEQUESTRATION

TOTAL TONS OF OFFSETS

Reaching the target number of carbon offsets is easily achievable with the forest management proposal. By using a third party, specifically a carbon project developer, to estimate the offsets for the considered parcels of land, an unregulated entity can facilitate the conservation or reforestation of the required acreage from the Native corporation.

ADDITIONALITY

The reason that these projects are additional is that the project either increase the carbon storage capacity of the forest land through afforestation and revegetation, or the project eliminates the possibility that the forest would have been cleared or deforested without the involvement of the project. This is consistent with VCS standards and CARB Protocol for carbon offset projects.

RISK OF ESTABLISHING CREDITS

Carbon sequestration through forest management projects meets the threshold for additionality, but still presents risk of disqualification. Specifically, in terms of the permanence of the carbon project, the possibility of leakage, and the risk of an unintended adverse consequence.

FINANCIAL COSTS

The financial costs for the project are subject to negotiation with the Native corporation and the costs of a carbon project developer. The benchmark for comparison is the $10-13/ton offset price available on the regulated and unregulated carbon markets. If an unregulated entity can negotiate a price that is on par with the price it would pay to simply buy carbon offsets outright at this rate, inclusive of the transactional costs and the cost of a project developer, then the carbon sequestration project is feasible from a financial cost standpoint. Larger scale increases the financial feasibility due to the up-front transactional costs.

SUBSIDIES

Not Applicable; PCE subsidies are for balancing out the heightened cost of diesel in rural communities. They are not relevant for a forest management plan.

TECHNICAL BARRIERS

In theory, improved forest management plans, avoided conversion, and reforestation plans are all theoretically straightforward in terms of effect on emissions reductions. The forest acts a sink for CO2; this carbon storage within the forest is called sequestration.

In practice, carbon market protocols require technically complex auditing and monitoring procedures, which must be performed initially by a carbon project developer, which the unregulated entity should hire, and which can provide training over the first few years in forest management techniques to the village corporation members.

PROCUREMENT AND TRANSACTION COSTS

While it is unclear whether carbon offsets are considered property, there are no prescriptive rules that limit the disposition of native corporation property in general, as such corporations are for-profits subject to Alaskan corporate law. Therefore, the environmental attributes of the project (in this case, the carbon offsets), may be permissibly conveyed to a third party such as Harvard. However, native corporations might wish that certain property rights are transferred to a certified land bank, to protect against creditor claims that might affect other rights on the same lands.

There is not a state-wide, uniform decisionmaking process for native village corporations. Each corporation has its own charter and bylaws that determine whether contracts with project developers or with an unregulated entity requires prior approval of the village corporation's shareholders. There may be relevant municipal or village corporation (or tribal) procurement laws. It may be possible to contract out of such requirements by, for example, obtaining a representation from the village corporation that they will waive the procurement requirements. Procurement laws at the village level may differ, and often require competitive bidding.

The costs incurred by the project itself will mostly be borne by the project developer. It is in the interest of both the unregulated entity and the village corporation that the contract stipulates the developer employ village residents wherever possible.

TAX INCENTIVES, CREDITS, LOANS

While Alaska does not currently have any forest carbon incentives, a few other states have such policies (e.g., those participating in RGGI, California, and Oregon). If significant new incentives arise in the future, due to a change in either state or federal law, then it is possible any additionality claims might need to be tailored. The contracts should account for such future changes and protect the unregulated entities' additionality claims for those offsets that were created prior to the policy shift. However, in the near future, it is unlikely that either Alaska or the federal government enacts such incentives.

CONTRACT ISSUES

SEE APPENDIX B

A tripartite contract mechanism will align the roles, limitations, and requirements of the unregulated entity, the carbon project developer, and an Alaska Native Village Corporation. Since carbon projects have been developed before, there is a precedent, but those arrangements would need to be modified to account for the unregulated entity's desired emissions reductions and other goals. Those designing the contracts should consult the California Air Resource's Board Compliance Offset Protocol for U.S. Forest Projects,[1] and Forest Trends' guidebook on the structure of contracts for forest carbon projects.[2]

1 "Compliance Offset Protocol U.S. Forest Projects." (n.d.): n. pag. California Environmental Protection Agency Air Resources Board, 25 June 2015. Web. 28 Apr. 2017.

2 Hawkins, Slayde, Michelle Nowlin, Daniel Ribeiro, Ryan Stoa, Ryke Longest, and Jim Salzman. *Contracting for Forest Carbon: Elements of a Model Forest Carbon Purchase Agreement*. Rep. N.p.: Forest Trends, 2010. http://www.forest-trends.org/documents/files/doc_2558.pdf.

GOVERNANCE COMPLEXITY

Under the proposed scheme, the unregulated entity will serve as an investor that provides grant or loan to the renewable energy project developer and receive the total or a portion of carbon offset credits in return. The project developer owns the renewable energy generation plant and sells the electricity or capacity to the utility to directly to large consumers.

However, problem may arise when distributing the carbon offset credits among different investors and the project developer. To eliminate this concern, contracts should explicitly state the ownership of the carbon offset and prevent future disputes on the distribution issue of offset credits.

ECONOMIC DEVELOPMENT POTENTIAL

Approximately 1 to 3 jobs in forest management could be created through a forest management project if job training for village residents was provided. For context, even one new job in a village can make a tremendous difference since unemployment ranges from 30 - 50% in the villages. The forest management skills are transferrable across many communities in Alaska, which is an opportunity but also presents the risk that villagers may take their new skills and move away from the village in search of higher wages in a larger population center.

DISTRIBUTIONAL EQUITY

The payments that the tribal corporation would receive from the deal are a potential avenue for distributional equity, with profits distributed to shareholders and could serve as an economic stimulus for villages that are often ignored by state and Federal agencies.

The funding could be leveraged for future innovations and improvements or held by the individuals who received it. However, not all tribal members are shareholders in the tribal corporation, which could create a deeper divide between shareholders and non-shareholders.

SOCIAL EMPOWERMENT

This plan offers some social capital co-benefits by preserving land for future hunting, fishing, and use by the members of the native corporation. Protecting the land from resource extraction and working to ensure smart forest management ward off potential encroachment by other entities in the future. Beyond these, social benefits not as immediate or tangible as some other projects.

PUBLIC HEALTH BENEFITS

Preventing deforestation and promoting reforestation increase vegetation, which provide a range of health benefits. Woodlands and trees have a positive impact on air quality through deposition of pollutants to the vegetation canopy, reduction of summertime air temperatures, and decrease of ultraviolet radiation.[1] Protected forests also offer recreational opportunities which provide significant contributions to increased physical activity among people.[2] Local communities, especially those that engage in subsistence living, benefit from the ecological health of the forest itself: most directly, a healthy landscape can sustainably provide meat and fish.

A forest experience can also contribute to improved emotional and cognitive health, such as recovering from stress,[3] improving concentration and productivity, and improving the psychological state, which also lead to positive physiological effects such as decreased blood pressure and heart rate and reduced anxiety and stress. Forests represent

1 Karjalainen, E., Sarjala, T., & Raitio, H. (2010). Promoting human health through forests: overview and major challenges. Environmental Health and Preventive Medicine, 15(1), 1–8. http://doi.org/10.1007/s12199-008-0069-2

2 Kline, Jeffrey D.; Rosenberger, Randall S.; White, Eric M. 2011. A national assessment of physical activity on US national forests. Journal of Forestry. 109(6): 343-351.

3 Shin, W. S., Yeoun, P. S., Yoo, R. W., & Shin, C. S. (2010). Forest experience and psychological health benefits: the state of the art and future prospect in Korea. Environmental Health and Preventive Medicine, 15(1), 38–47. http://doi.org/10.1007/s12199-009-0114-9.

rich natural pharmacies by virtue of being enormous sources of plant and microbial material with known or potential medicinal or nutritional value.

Meanwhile, coal deposits underneath the forest that are left untouched also prevents further emission of toxic air pollutants, keeps the air clean, and leads to reduced cardiovascular and respiratory negative health outcomes. One potential risk though is when community members, as part of forest living, burn fuelwood for heating, which emit particulate matter and other pollutants that may harm the respiratory system.

EDUCATIONAL BENEFITS

Protecting the forest will offer several educational benefits. Community members will undergo skills training to ensure an inclusive and participatory approach to forest management. Children and young people will learn about the importance of natural resources outside the classroom and in the natural setting. Protected forests can also be educational for tourists and residents alike.

Option 3: Renewable Energy Project

FEASIBILITY STUDY

PROJECT FACTS

- RENEWABLE ENERGY PROJECTS IN ALASKA HAVE THE POTENTIAL TO PROVIDE CLEAN, CARBON-FREE ENERGY FOR RURAL COMMUNITIES THAT ARE RELIANT UPON BURNING DIESEL FOR POWER GENERATION
- THERE ARE ABUNDANT SITES SUITABLE FOR DEVELOPMENT OF SOLAR, WIND, AND HYDRO RENEWABLE ENERGY PROJECTS
- WITH FEDERAL AND STATE GRANT FUNDS DRYING UP, COMMUNITIES ARE COMPETING FOR LIMITED POOLS OF CAPITAL, INCLUDING DEBT FINANCING
- AN UNREGULATED ENTITY COULD SPONSOR A RENEWABLE ENERGY PROJECT FOR A RURAL COMMUNITY IN EXCHANGE FOR CARBON OFFSETS

BACKGROUND

Rural communities in Alaska are often disconnected from the main grid, called the "Railbelt", which runs north from Anchorage through central Alaska. Rural communities that are disconnected from the Railbelt normally receive electricity generated by diesel powerhouses. Since these villages are remotely located, transporting the required diesel by tanker or even by air drops is a significant logistical challenge, resulting in even higher diesel costs.

As a result, rural Alaskan communities often pay extraordinarily high prices for electricity, ranging from 60-90¢/kWh, despite being subsidized by Power Cost Equalization (PCE). Because of their lack of access to natural gas, these remote communities primarily rely on heating oil for their household heating, which often costs in excess of $3.00/gallon. Because of the relatively small size of these communities (several thousand residents for a larger hub community, 20-100 residents for a rural village), these GHG emissions are typically not viewed as significant enough to warrant attention from a climate change perspective. However, some local utilities serving these communities are incorporating renewable energy projects for economic reasons.

Instead of paying 60-80¢/kWh for diesel power, shifting to wind-diesel or hydro power can result in electricity prices in the 20-50¢ range. Unfortunately, the large, upfront capital costs can prevent renewable projects from moving forward. Given the high price of diesel-generated power, the ease of distributing direct current power through a microgrid instead of on a traditional, larger grid requiring transformers and costly transmission lines, and the abundance of wind and hydro sources, renewable energy projects in rural Alaskan communities are fairly common.

Nevertheless, renewable energy projects in Alaska face significant financial challenges, mostly due to Alaska's economic situation since the collapse in petroleum prices. Many projects are not financially viable for traditional renewable energy capital providers such as banks, equity investors, project developers, and tax equity sponsors. In the past, smaller scale projects were financed by Federal and State grants. However, many grant funds have dried up since the State has lost much of its tax revenue due to low oil prices, and renewable energy project developers and communities find themselves competing for a limited mix of grant funds and loans.

Adding to the challenge is the fact that many of the most financially-attractive projects were funded by the

now defunct state grant program. An unregulated entity could aid in the financing of a renewable energy project for a remote Alaskan village in exchange for carbon offsets.

PROJECT DESIGN

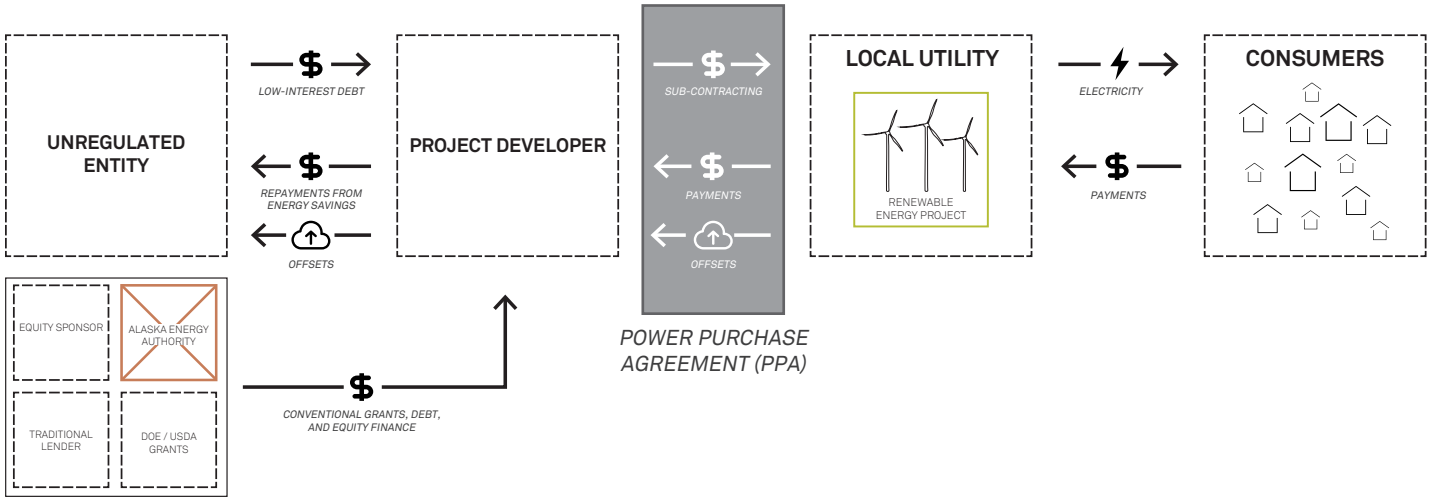
Much like the current financing mechanisms, an unregulated entity could provide either grant funding or debt financing depending on their own organization's goals and objectives, cost of capital, and incentives. For instance, a non-profit institution like a major university could access funds from its endowment and grant them to rural Alaskan, 50-resident village in order to fund a small-scale (~100kW) wind turbine.

The up-front capital to do so would be $350k-500k and then it would be the obligation of the community's utility source to pay the O&M costs for the life of the wind turbine (which could create a co-benefit of several jobs for local residents). One challenge here is that although the project would clearly meet the additionality threshold in terms of displacing diesel usage for power generation, the actual impact in terms of tons of CO_2 would be relatively minor for such a small community.

Another financing mechanism would be for an unregulated entity, such as a public corporation, to provide a low-interest loan for a hub-community (~2,000 residents) to purchase a 1MW wind turbine. Communities this size may already receive debt financing from banks and pay relatively low interest rates in the 2.75-4.0% range, which may be further guaranteed by a DOE loan program for instance. An unregulated entity could provide additional financing for this renewable project in the form of a low interest loan.

In either mechanism, the unregulated entity must still partner with a project developer, and the local utility. The renewable energy project developer and utility will actually manage the process of selecting the site,

RENEWABLE ENERGY PROJECT PROGRAM DESIGN



Financial Analysis

Instead of free money in a grant, debt financing offers the unregulated entity some degree of a return, albeit at a level that is significantly less than their cost of capital (for which they are compensated by the offsets).

Specifically, the unregulated entity would enter the capital stack in a subordinated position to the bank, but at a lower interest rate of 2.0-2.5% range, in exchange for carbon offsets. This has several advantages for the community. Offering a lower interest rate than a traditional lender reduces the cost of capital for the overall project. Counter-intuitively, by providing a lower interest rate, but in a subordinated position, the unregulated entity is essentially de-risking the project. (By being in a subordinated position, a debt or equity investor should demand a higher expected return in compensation for increased risk).

By providing low-interest debt financing rather than simply a grant, the unregulated entity can sponsor a larger renewable energy project, for which there will be a much greater reduction in GHG-emissions and, correspondingly, much more emissions offsets.

(In fact, with additional financing from the unregulated entity, the community could afford to build an even larger project with excess capacity backed up by battery storage, for which they could attract commercial customers at lower energy cost than they would pay with a diesel-based system. This is particularly the case in hydro-kinetic projects.)

Finally, debt has a disciplining feature that free money does not: by having some skin in the game, the local utility, the village, and other stakeholders have a reason to maintain the assets and pay back their debt, both to any lender and the unregulated entity, in a way that they would not if it were simply free money that they did not have to return.

designing the facilities, construction, operations and maintenance.

The project developer would also have to coordinate the Power Purchase Agreement and finding other sources of capital, such as an equity sponsor and lender. The unregulated entity would merely provide an additional form of financing in exchange for the carbon offsets.

For the unregulated entity, there are several advantages to this approach. First and foremost, the unregulated entity would receive the emissions offsets from the project uncontested in order to reduce its own carbon footprint towards its sustainability goals.

Again, there is no question of additionality since the project would not have otherwise succeeded and since it clearly replaces the use of a GHG-emitting fossil fuel-based plant.

Legal Analysis

A contract mechanism, called a Power Purchase Agreement, would include the unregulated entity, the project developer, the utility, and varied lenders/grant providers. Construction of a renewable energy project can be quite complicated, particularly regarding the financing, as funding might be cobbled together from a variety of loan and grant programs, some of them public and others private.

The unregulated entity should demand warranties and representations from the utility that the utility has secured and will continue to be responsible for other sources of financing, as well as managed the licensing, site leasing, etc. One fairly simple approach would boil down to just two contracts: the unregulated entity provides a loan to the utility in exchange for the credits, in a tripartite contract between the unregulated entity, the utility, and the project developer.

The loan provided by the unregulated entity to the utility should include:

- Clear definition of terms.
- Identify the parties, set the amount of the loan, duration, interest rate, and other standard terms.
- Express the purpose of the contract: to construct a renewable energy project.
- A representation from the electric utility that but for the participation of the unregulated entity, such a project would not occur.
- Guarantee exclusive unregulated entity ownership of the offsets.
- A representation from the utility that they have secured all relevant permits and that the project conforms with procurement laws.
- Arrange for the conveyance of a mandatory minimum of offsets to the unregulated entity.
- Warranty from the utility that they will perform all relevant record-keeping, baseline setting, verification, and audits in conformity with the relevant protocol. If that protocol requires third party verification, then the contract should identify a relevant third party and the utility should provide an indemnity.
- Limitation on the unregulated entity's liability.
- Dispute resolution, termination, and change in law provisions.

Additionality Analysis

Additionality should not be a major obstacle for renewable energy power generation projects in Alaska, as long as the project would have not been able to advance without the investment or involvement of the unregulated entity. As with other projects, a renewable energy project still faces several risks in terms of obtaining offset credits, even if it passes the additionality clause. For instance, permanence refers to the life of the project, which can be well over 30 years.

However, if the renewable energy project fails for some reason (i.e. wind turbine damage due to natural disaster), then the offsets expected over the life of the project would not be able to be claimed by the unregulated entity. In addition, leakage could occur if, for instance, the lowered cost of electricity causes consumers to actually use more electricity (perhaps for heating), ultimately increasing carbon emissions

Case Study

RENEWABLE ENERGY PROJECTS

Falls Creek Hydroelectric

Hydroelectric projects have been some of the most successful renewable energy projects in Alaska. Although they require high up-front capital expenditures, hydro projects are marked by low operating and maintenance expenses, and very long project lives (up to 50 years of more). Hydroelectric sources are abundant in Alaska and provide a highly effective means of replacing power generation by diesel. For example, in late 2008, the Gustavus Electric Company constructed a 130' long, 16' tall run-of-the-river hydroelectric facility for the town of Gustavus, Alaska, which has a population of approximately 450.

This 800 kW hydroelectric facility provides 90% of the electric power for the town and offsets 20,000 gallons of diesel fuel per month. At a rate of 22.4 lbs CO2/gallon, this project could potentially offset over 120,000 tons of CO2 over the course of its 50-year life! The Gustavus Electric Co. has a 50-year lease for the facility, and the project had a total cost of $8.5M, including $5.75M from Federal and State grants; the remainder came from equity and debt financing.

FALLS CREEK HYDROELECTRIC FACILITY

Case Study

RENEWABLE ENERGY PROJECTS

Given the current shortage of grant funding, this is an ideal renewable energy project for an unregulated entity to sponsor – in terms of size of the community, financing requirements, and impact on GHG emissions reductions.

Again, in this mechanism, the unregulated entity could essentially subsidize the debt financing (perhaps in the $1-1.5M range) with low-interest, subordinated debt, so that the utility company can avoid taking out more equity or traditional debt financing, given the scarcity of grant funding available. In exchange, the unregulated entity would be repaid from the cash flows of the project over a long term (and at a rate lower than their typical cost of capital), but would receive the added benefit of being able to claim the carbon offset credits for the replacement of diesel-generated power with hydroelectric power.

Feasibility Analysis

RENEWABLE ENERGY PROJECT

TOTAL TONS OF OFFSETS

The ability to generate offsets from a renewable energy project varies greatly, For example, the hydroelectric project in Gustavus offset 20,000 gallons of diesel fuel/month, or 2,450 emissions offsets/year. By extending these offsets over the course of the 50-year lifetime, the project offsets 122,500 tons of CO2. Given the size of these communities, an immediate offset of 50,000 tons of CO2 is impossible with one renewable energy installation, unless there is an increase in electricity demand in the villages.

ADDITIONALITY

Project-specific additionality test is suggested for renewable energy projects instead of a performance standard test, since Alaska renewable energy projects are unique compared to similar projects in the lower 48 states and therefore should not follow the same baseline standard as renewable energy projects elsewhere. The communities that would be the site of a renewable energy project are currently served primarily by burning diesel, so switching to primarily renewable energy for power generation should to be additional. Since Alaska does not have carbon emission standard nor renewable energy portfolio standards, the project will have no problem passing a regulatory test.

One potential challenge is the “Common Practice Test”, which in essence declares that if the type of renewable energy has become the common practice in the sector or region, than implementing the project is not additional since it would have occurred regardless of the actions of the unregulated entity.

RISK OF ESTABLISHING CREDITS

Although additionality should not prevent a significant barrier, there are several other risks to claiming offset credits for the unregulated entity sponsoring the project. These include permanence, leakage, and unintended consequence. Since the renewable energy project will provide electricity over a long period of time (30-50 years), it's plausible that the local utility would have switched to the renewable energy source regardless of the actions of the unregulated entity. As such, the unregulated entity may not be able to claim the carbon offsets for the full life of the renewable energy's assets.

Leakage occurs when emission avoided within the project are displaced to another location or time, or when the offset project leads to forest clearing elsewhere. In our project, leakage risks occur when the reduced fuel cost due to the generation of renewable energy encourages the customers to consume more energy and increase the carbon emissions.

One unintended adverse consequence would be that the project may result in the damage of nearby ecosystems, which reduces its ability to absorb carbon or increases the carbon emissions from the ecosystem. For example, hydro projects may affect the downstream river ecosystem or cause flood or drought to downstream land ecosystems. To prevent this damage, due diligence and continuing monitoring need to be conducted before, during and after the project.

FINANCIAL COSTS

Given the lack of regulation/demand for carbon offsets and the need for additional capital, an unregulated entity sponsoring a project with either a grant or low-interest loan should be able to claim all of the carbon offsets from the life of the renewable energy project. In the example of the Falls Creek hydroelectric facility, the cost for the offsets would be $12.50/ton if the unregulated entity provided $2M in low-interest debt for up-front capital costs.

SUBSIDIES

PCE credits may be a perverse incentive for building either a wind or a hydro project for a village utility. The amount of PCE that a utility receives is determined by both fuel expenses and non-fuel expenses. Non-fuel expenses include costs such as salaries, insurance, taxes, power plant parts and supplies, interest, and other reasonable costs.[1] If a community builds a hydro or wind project, that project would reduce their fuel expenses and thus lower their PCE. However, if the project is carefully structured, the PCE payment could be leveraged rather than act as a barrier.

If a renewable energy project developer can raise the non-fuel expenses, then the village utility can protect against a reduced PCE. One common way to raise non-fuel expenses is to fund a project through loans rather than through grants; this allows the utility to account for the interest as a non-fuel expense and claim PCE credits. However, the details of the PCE equation are project-specific and it would be necessary to work through this funding mechanism with the Alaskan government to ensure it passes muster with the regulatory authorities.

---

1 Alaska Energy Authority. Anchorage. *Power Cost Equalization Program Guide*. Alaska Energy Authority, 01 July 2014. Web. 21 Apr. 2017. <http://www.akenergyauthority.org/Content/Programs/PCE/Documents/PCEProgramGuideJuly292014EDITS.pdf>.

TECHNICAL BARRIERS

Given the large geographic area with relatively little if any human development, there are numerous sites available that are ideal for solar, wind, and hydro projects. These technologies are well understood and the cost for material, i.e. wind turbines and PV panels, are decreasing rapidly with time. Furthermore, as battery storage technology and capacity improves, utilities will be better able to maximize the electricity generating capacity of the assets, i.e. storing energy from PV panels during the day to use at night when power demand is higher.

Beyond that, in Alaska specifically, numerous sites have been selected and surveyed for renewable energy projects. The challenge is not finding abundant sources of renewable energy; rather it is finding the means to sponsor renewable energy projects for rural Alaskan communities whose local utilities are currently reliant upon diesel for power generation.

PROCUREMENT & TRANSACTION COSTS

Procurement laws might be relevant if the unregulated entity contracts directly with the municipality or native village corporation. (In that is the case, see the procurement law section for the forest management plan proposal.) However, if the unregulated entity works with a rural electric utility, such procurement laws would not apply. Some rural electric cooperatives are structured as 501(c)(12) non-profits under state law: a “private non-profit.”

These organizations have a fair amount of autonomy as consumer-owned utilities that answer to a board of directors.[1] That said, building a strong working relationship with such cooperatives will be essential; the unregulated entity and project developer should, wherever possible, consider employing the services of the consumers on the renewable energy project construction, operation, and maintenance.

1 Personal Interview with Clay Koplin, Cordova Electric, following the Alaska Energy Finance Seminar, BP Energy Center, Anchorage, AK, March 1, 2017.

TAX INCENTIVES, CREDITS & LOANS

On paper, there remains an Alaskan Power Project Loan Program for hydro and wind projects, but it is unclear how much in loans is available through that program. As for Federal incentives and credits, the DOE offers a Tribal Energy Program for wind and hydro, available to tribal governments. The DOE also offers a Loan Guarantee Program for local governments engaged in hydro or wind projects. The USDA offers a High Energy Cost Grant Program for tribal governments or local governments working on wind and hydro projects.

The Rural Energy for America Program (REAP) in the USDA includes both a loan guarantee program (covering 60-85% of a loan up to $25 million) and a grant program (maximum 25% of the project cost). Hydro and wind projects are eligible for both of the REAP programs. There are also Federal subsidies available for wind (Production Tax Credit) and solar (Investment Tax Credit).[1]

---

1 For a quick reference, see "Programs." DSIRE. NC Clean Energy Technology Center, 2017. Web. 27 Mar. 2017. http://programs.dsireusa.org/system/program?fromSir=0&state=AK. See also, Ardani, K., D. Hillman, and S. Busche. Financing Opportunities for Renewable Energy Development in Alaska. Publication. Washington DC: National Renewable Energy Laboratory, 2014. NTIS No. DOE/IE-0014. Print.

CONTRACT ISSUES

A Power Purchase Agreement will be the critical contracting mechanism for the renewable energy project. The parties include the unregulated entity, the project developer, the utility, and varied lenders/grant providers. Construction of a renewable energy project can be quite complicated, particularly on the financing side as the funding might be cobbled together from a variety of loan and grant programs, some of them public and others private.

The PPA will ensure that the project developer and the utility have a guarantee of exchanging electricity for revenue within a given range of prices, from which the project developer will have to repay any debt and equity holders. Having the PPA in place ensures that all parties adhere to the arrangement.

GOVERNANCE COMPLEXITY

Under the proposed scheme, the unregulated entity will serve as an investor that provides grant or loan to the renewable energy project developer and receive the total or a portion of carbon offset credits in return. The project developer owns the renewable energy generation plant and sells the electricity or capacity to the utility to directly to large consumers. However, problem may arise when distributing the carbon offset credits among different investors and the project developer. To eliminate this concern, contracts should explicitly state the ownership of the carbon offset and prevent future disputes on the distribution issue of offset credits.

ECONOMIC DEVELOPMENT POTENTIAL

There are definite training and job opportunities for village residents to perform operations and maintenance work on a renewable energy project. A wind project would likely only need preventative work done, but a hydro-diesel project that involves the diesel powerhouse may require both preventative and operation work.

In remote villages, it would be difficult to send qualified personnel for both preventative and, more significantly, reactive maintenance. This challenge presents the opportunity to train local residents makes much more sense for the success of the project in terms of response time, but it will be challenging to provide adequate training and education for local residents taking the job.

DISTRIBUTIONAL EQUITY

A renewable energy installation is a strong opportunity for increasing social capital in the village and scores well when considering distributional equity. Furthermore, the fact that these villages are overlooked as potential sites for renewable energy projects makes a more compelling distributional equity argument.

SOCIAL EMPOWERMENT

A renewable energy project that provides lower energy costs for a village is a highly effective approach for increasing social empowerment and capital in a community. Energy savings could be used to expand village programming, increase educational or job opportunities, and assist with other needs within the community. The importance of energy independence should not be understated; easing the community's concerns about energy costs will relieve an enormous burden and improve quality of life in the village.

PUBLIC HEALTH BENEFITS

Overall, different types of renewable energy can benefit public health by displacing emissions of harmful pollutants such as particulate matter (PM2.5), nitrous oxide (NOx), and sulfur dioxide (SO2) produced from fossil fuel-driven electricity generation.[1] Reductions in health-damaging pollutant emissions would decrease risks of cardiovascular disease, chronic and acute respiratory illnesses, lung cancer, and preterm birth.[2] Furthermore, a switch to renewable energy sources can reduce the occupational health injuries associated with the fossil fuel industry.

These benefits are ultimately translatable into lower number of hospitalizations and emergency room visits, lower preventable healthcare spending, and improved population health. This is particularly beneficial for Alaska native communities who already experience limited healthcare access due to geographic and economic barriers,[3] and are susceptible to unique health conditions (ex. zoonotic diseases[4]) as a result of its extreme climate.

---

1 Buonocore J J, Luckow P, Norris G, Spengler J D, Biewald B, Fisher J and Levy J (2016). Health and climate benefits of different energy-efficiency and renewable energy choices Nat. Clim. Change 6 100–5.

2 Smith KR et al. (2013). Energy and Human Health. Annual Review of Public Health 34:159-88. http://dx.doi.org/10.1146/annurev-publhealth-031912-114404; Health Care Without Harm (2015). Health Impacts of Energy Choices. Available from: http://www.healthyenergyinitiative.org/wp-content/uploads/2015/10/Health-Impacts-of-Energy-Choices_DigitalVersion.pdf.

3 Newkirk, V II (2016). Health Care Falters on the Last Frontier. The Atlantic. Available from: https://www.theatlantic.com/politics/archive/2016/07/alaska-health-insurance-exchange-obamacare/489599/.

4 Hueffer K, Parkinson A, Gerlach R, Berner J. Zoonotic infections in Alaska: disease prevalence, potential impact of climate change and recommended action for earlier disease detection, research, prevention and control. Int J Circumpolar Health. 2013;72:19562.

EDUCATIONAL BENEFITS

Building new renewable energy facilities can also be an educational endeavor for the entire community. Residents might update their technical skills regarding utility management, or use the clean energy facility as a teaching opportunity in environment and health classes in local schools. Community members, and most especially those who will run the updated utility, might need to be taught by the project developer entirely new technical skills essential for the installation and maintenance of the new system.

Money saved from reduced fuel oil use could be redirected towards educational programs, particularly in maintaining schools that may be in the brink of closure. This is especially important in rural Alaska, as schools provide a community space in addition to a center for education.

Conclusion

FEASIBILITY ANALYSIS

As mentioned in the introduction, our team opted to move forward with an implementation plan for an adapted forest sequestration project. Given the geographic isolation and small population size of many Alaska Native communities, the team was repeatedly confronted with a basic trade-off between distributional equity and efficiency concerns. While weatherization interventions generate significant health benefits and reduce home energy costs, it is impractical to use carbon offsets as financing leverage because the resulting offsets are limited.

On the other hand, forest sequestration projects can easily be scaled to meet the offset requirements of an unregulated entity, but do not generate the same benefits for residents. In order to resolve this tension, we propose a project that can achieve significant offsets at scale, while also funding the types of interventions that would be uneconomical, were they advertised as a carbon offset opportunity. The result is "Forest Sequestration +."

Forest Sequestration + allows for an unregulated entity to achieve its offsets goals, provide significant health benefits, and build a relationship with a community. In the case of a university, a partnership with a Alaska Native Village Corporation on a forest sequestration + project might allow for the opportunity to conduct research on the forest carbon project, as well as explore the possibility of commercializing additional offsets from weatherization upgrades.

To implement this project, the team proposes that the unregulated entity partner with three main entities:

1. A forest project developer who will be in charge of implementing the improved forest management plan and ensure the generation of permanent and credible carbon offset credits;

2. A Native Village Corporation who owns the forest land and will receive payment from the sale of carbon offsets;

3. A local contractor or Energy Service Company (ESCO) that will receive the social impact funding and implement the weatherization projects for the native community.

The forest carbon project will be designed according to the California Air Resources Board Compliance Offset Protocol to ensure the legitimacy and credibility of the carbon offset credits. For further details regarding the implementation of this project, please refer to the team's implementation proposal.

APPENDIX A

CONTRACTING DETAILS FOR WHOLE VILLAGE WEATHERIZATION

The Master Agreement: tripartite contract between a bank, an ESCO, and the unregulated entity.

This tripartite contract acts as a "Master Agreement" that governs all future, discrete work tasks undertaken by the ESCO for the villages. The ESCO provides a project savings guarantee for each of those future projects. The unregulated entity contributes cash to a revolving loan fund (perhaps at 0% interest), held by a bank. The ESCO withdraws money from that fund in order to perform the village efficiency projects. The ESCO pays itself out of the energy savings generated, as well as returning a portion of those savings back into the loan at the bank.

The provisions in the Master Agreement should include the following:

- Clear definition of terms
- Identify the parties, set the amount of the loan, duration, interest rate, and other standard terms.
- Express the purpose of the contract: to provide the ESCO with the funding necessary to perform a varied of tasks that fall within defined types for identified villages, in exchange for a portion of the savings and the creation and conveyance of offset credits to the unregulated entity.
- A representation from the ESCO that, but for the participation of the unregulated entity, such a project would not occur (a similar provision for each of the contracts between the ESCO and the village will be necessary as well, in order to bolster additionality claims).
- A guarantee from the ESCO to deliver a certain minimum number of offsets within a certain time frame and a guarantee that the unregulated entity will retain exclusive right to the offsets
- A representation from the ESCO that it will only perform tasks that "pay off" within a prescribed time frame and at a certain rate, thus guaranteeing a certain return rate to the loan fund.
- A representation from the ESCO that any villages with which it contracts, pursuant to the rotating loan fund, will have secured all relevant permits and that the project conforms with procurement laws.
- Warranty from the ESCO that they will perform all relevant record-keeping, baseline setting, verification, and audits in conformity with the relevant protocol (depending on the desired offset market). The parties should decide whether a third party should verify this information (the protocol may require this).
- A provision for auditing compliance from all parties involved.
- Provisions establishing a reserve fund for offset purchases on the cap and trade market as a backstop to the guarantee
- An indemnity from the ESCO for liability arising from the activity of its subcontractors.
- Limitation on the unregulated entity's liability.

- Dispute resolution, termination, and change in law provisions.

The Village-level Agreements: Contracts between the ESCO and the villages, with the unregulated entity as a beneficiary.

The ESCO manages the bundles of village efficiency work and contracts with the village to perform such work and pay itself back in energy savings. The village is the one that proposes the desired work. The ESCO handles the offsets that are generated by these projects and delivers them to the unregulated entity as a third party to the ESCO-village contract. It might be necessary for either the unregulated entity or for the ESCO to hire a third party auditor, to verify the baseline and energy savings that accrue as a result of the work performed by the ESCO under each of these village-level contracts.

The provisions in each of the village-level agreements should include the following:

- Clear definition of terms.
- Identify the parties: the ESCO and the municipality, native village corporation, or the utility.
- Express the purpose of the contract: to perform energy efficiency projects that pay for themselves, in exchange for carbon offsets and a portion of the savings generated.
- A guarantee of access from the village.
- The ESCO should covenant with the village to subcontract with qualified local residents for project construction, maintenance, etc.
- A representation from the village that but for the ESCO, and in turn the funding provided by the unregulated entity, the project would not be performed.
- A warranty from the ESCO and from the village community that they make no claims to RECs or carbon offsets generated by the project.
- Identification of the unregulated entity as a beneficiary that receives the offset credits.
- A thorough proposal from the village with baseline metrics; a representation from the village that all information presented to the ESCO is truthful and that the proposed work plan conforms with any relevant procurement laws.
- A warranty from the village that it will pay back the ESCO a portion of the energy savings over a period of years.
- Some provisions addressing the risk of the house being abandoned.
- Limitation on the unregulated entity's liability.
- Dispute resolution, termination, and change in law provisions.

APPENDIX B

BACKGROUND ON THE ALASKA NATIVE CLAIMS SETTLEMENT ACT

Although Alaska Natives have the same legal status as members of Indian tribes singled out in the Commerce Clause of the US Constitution,[1] Alaska Native land law is quite different from Federal Indian law writ large. Shortly following the 1958 Statehood Act, growing pressure to resolve native claims to land from state and oil companies led to the 1971 Alaska Native Claims Settlement Act (ANCSA). ANCSA is a federal law that permitted the conveyance of about 45 million acres of land to regional and village corporations, formed under state law, and the transfer of about one billion dollars in exchange for the extinguishment of native land claims (with some minor exceptions). ANCSA converted communal land claims into private property (represented by stock).

The regional and village corporations are for-profit entities that served as vehicles for distributing the settlement to eligible native shareholders. In 1998, the US Supreme Court ruled that Alaska Native lands held by such corporations are not Indian country, meaning that unlike reservation land, tribal governments have limited authority. The village and regional corporations are distinct from tribal governments recognized by the federal government. There are over 200 federally recognized tribes in Alaska. Some small villages have a municipal government, a tribal government, a village corporation, and are part of a regional corporation as well.[2] Although in some cases the same individuals serve in those parallel governing body, the governance complexity can be a challenge.[3]

There are twelve regional corporations (a 13th, for out-of-state Alaska Natives, is insolvent) with varying amounts of surface and subsurface lands, shareholders, and village corporations. In some ways, these entities are like any corporation and are subject to the state's corporate laws, with limited exceptions identified in Alaska Stat. § 10.06.960. However, they are exempt from some financial reporting requirements and SEC laws. Regional corporations possess subsidiaries and are large, diverse businesses with significant revenue, often from resource extraction (e.g., the Arctic Slope Regional Corporation had gross revenues of 2.3 billion in 2010). The regional corporations follow different governance structures and there are wide differences in terms of the number of directors and the number of village corporations.

While native corporations are for-profit entities, under ANCSA, corporations may provide benefits that promote the health, education, or welfare of shareholders and other Alaska natives, and their articles of incorporation, filed with the state of Alaska, establish their intent to provide such benefits. Examples of these benefits include building a wind turbine, distributing firewood, and managing property leases and easements.

Many corporations indicate that subsistence use

1 The material in this section is drawn from Case, David S., and David A. Voluck. *Alaska Natives and American Laws*. Fairbanks, AK: U of Alaska, 2012. Print; and Cohen, Felix S., and Nell Jessup. Newton. *Cohen's Handbook of Federal Indian Law*. New Providence, NJ: LexisNexis, 2012. Print.

2 Tribal self-government is varied. Tribes exist side by side with village corporations and may have members and shareholders in common. However, *Alaska v. Native Village of Venetie* sharply limited tribal jurisdiction. The townsite lots of native villages, however, are likely still Indian country, despite the Venetie decision and so those lots may not be alienated without the consent of the Secretary of the Interior and are the functional equivalent of native allotments.

3 See the following report for more details: Cornell, Stephen, Victor Fischer, Kenneth Grant, Thomas Morehouse, and Jonathan Taylor. *Achieving Alaska Native Self-governance: Toward Implementation of the Alaska Natives Commission Report*. Rep. Anchorage: Institute of Social and Economic Research, 1999. Print.

is their primary or highest-priority use of the land. Sustainable subsistence usage means that members can use the lands for hunting, camping, timber, etc. Similar to other corporations, shareholders can file lawsuits against corporations for failing to maximize shareholder value. However, no shareholders have won cases as the business judgment rule typically protects board members from liability.

One important and unique aspect of ANCSA is the so-called 7(i) provision, which requires that 70% of "all revenues received" by each regional corporation from the "timber resources and subsurface estate patented to it" be divided among the 12 regional corporations according to the number of natives enrolled in each region. This provision does not apply to villages, of which there are 173. Initially there were 204 village corporations, but some of those villages merged. The regional corporations have the obligation to distribute 50% of the 7(i) revenues to village corporations pursuant to 7(j). The initial statutory language of the provision led to a number of lawsuits, which were ultimately resolved in the 7(i) agreement which was signed by the 12 regional corporations in 1982 (See U.S.C.A. § 1606(i) and (j)). The regional corporations hold title to the subsurface estate of nearly all lands conveyed to them under the act, although subsurface mineral development within the curtilage of the village is subject to approval by the affected village corporation that owns the surface estate.

A Federal Appeals Court held in 1998 that village corporation consent is required only for regional mining activity within the curtilage of the village and not necessarily for development on village lands outside the curtilage of the village.[4] Subsurface resources on village lands cannot be sold without the regional corporation's consent (and their sale is subject to the revenue-sharing requirements of 7(i)). Once land is conveyed to village corporations, the village re-conveys the lands without consideration as parcels in fee to occupants.

Section 21(d)(1) of ANCSA did not impose any restrictions on land conveyed to the native corporations, making them freely alienable. There was later concern about the loss of native control of lands, and so the Alaska National Interest Lands Conservation Act (ANILCA) of 1987 exempted ANCSA land from adverse possession, creditor claims, etc. The exemptions apply to ANCSA lands and interest in lands as long as they are "not developed or leased or sold to third parties". "Developed" and "leased" means land put to "gainful and productive present use" but excludes activities like surveying, exploration, and subsistence.

Carbon offsets are a new development and the land bank protections in ANILCA have not yet been tested. That is, transferring carbon offsets to a third party might bring ANCSA lands out of the exemption from creditor claims. The Chugach land manager stated that their agreement was similar enough to other projects that did not remove the land bank protections that they were willing to bear that risk. The sale of a resource (such as the coal development rights) to non-ANCSA entities does remove that resource from the land bank protections but not the rest of the property interests. If a non-ANCSA creditor has the right to develop the subsurface right, that would degrade the surface rights.

4 See *Lesnoi, Inc. v. Stratman*, 154 F.3d 1062 (9th Cir. 1998)

APPENDIX C

CONTRACTING DETAILS FOR A FOREST CARBON PROJECT

The unregulated entity enters into a multilateral contract with the Native Village Corporation under AS 10.06.010 (or with a regional corporation acting on behalf of village(s) under ANCSA Sec. 7(n)) and with the carbon project developer. Such a contract should continue the following terms:

- Clear definition of terms.
- Identify the parties, set the price, duration, and other standard terms.
- Express the purpose of the contract: to secure land for subsistence and other benefits while generating carbon offsets.
- A representation from the project developer and Native Village Corporation that but for the guaranteed purchase from the unregulated entity, such a project would not occur.
- A representation from the Native Village Corporation that they have title to the land and that the arrangement complies with all village corporation and relevant municipal procurement laws.
- Arrange for the conveyance of a mandatory minimum of offsets to the unregulated entity. Guarantee the unregulated entity retain exclusive ownership of a percentage of the total offsets. The project developer should receive a percentage of the total offsets as their payment, which gives them an incentive to ensure the offsets conform with the relevant protocol (see California Air and Resources Board protocols on forest carbon projects). The corporation and the land bank should provide a warranty that they will not claim the carbon offsets in any promotional materials.
- Warranty from the project developer that they will perform all relevant record-keeping, baseline setting, verification, and audits in conformity with the relevant protocol. If that protocol requires third party verification, then the contract should identify a relevant third party and the carbon project developer should provide an indemnity.
- The Corporation will provide site access to the unregulated entity and the project developer.
- Limitation on the unregulated entity's liability.
- The project developer or the unregulated entity (or both) covenant with the corporation to subcontract with qualified Native Corporation shareholders for the performance of verification and auditing.
- Regarding the educational component, the project developer agrees to train Native Corporation shareholders/residents in the relevant forest management techniques over a period of several years, with the intent to hand-off the primary management of the project into the future. If the unregulated entity is an educational institution, it may wish to covenant with the Native Corporation for future access and cooperation in arranging visits for its students.
- Guarantee of non-assignment of offsets.
- Dispute resolution, termination, and change in law provisions.

The land bank conveyance:

If there are minerals under the forest, then the right to develop such minerals should be conveyed to a certified land bank, to ensure that such rights are not available to a creditor in the case of corporate insolvency (see ANILCA land bank provisions). Since regional corporations are more likely to hold subsurface rights, such an arrangement might require a contract with the regional corporation.

If such minerals have declined in value since their initial conveyance to the corporation, and the corporation wishes to protect the viability of subsistence living on those lands, the regional corporation might agree to such a deal for tax purposes.

APPENDIX D

CONTRACTING DETAILS FOR A RENEWABLE ENERGY PROJECT

The Emmett Environmental Law and Policy Clinic at Harvard has already performed a thorough analysis for the preferred contractual terms of a tripartite contract between the utility, the unregulated entity, and the project developer. That memo addresses potential partners for such a project other than a utility (such as a municipality, private individual, or Alaska Native Village Corporation). That memo is available through the clinic, but should be supplemented with the following provisions:

- The project developer should provide a guarantee that it will subcontract with qualified local residents for project construction, maintenance, etc.

- The project developer should indemnify all subcontractors.

- The utility should promise the unregulated entity that the utility pay for third party auditors to verify the diesel fuel displaced by the project, and guarantee the conveyance of the generated offsets.

- A warranty from the utility and the project developer that they make no claims to RECs or carbon offsets generated by the project, unless the project developer's fee included a percentage of the offsets.

  If the fee includes a percentage of the offsets, the developer would have an incentive to ensure offsets conform with the relevant protocols.

APPENDIX E

REFERENCES TO LEGAL SOURCES

Legal Casebooks

- Case, David S., and David A. Voluck. *Alaska Natives and American Laws*. Fairbanks, AK: U of Alaska, 2012.

- Cohen, Felix S., and Nell Jessup. Newton. *Cohen's Handbook of Federal Indian Law*. New Providence, NJ: LexisNexis, 2012.

Major Federal Laws relevant to Alaska Natives

- Alaska National Interest Lands Conservation Act of 1980, 43 USC 1602-1784, approved December 2, 1980, (94 Stat. 2371).

- Alaska Native Claims Settlement Act of 1971, 43 USC 1601-1629h, enacted December 18, 1971, (85 Stat. 688).

Assorted Federal and State Programs

- Alternative Energy Conservation Loan Fund (State), AS 45.88.010 - 45.88.090.

- Business Energy Investment Tax Credit (ITC) (Federal), 26 USC § 48, H.R. 2029, enacted December 18, 2015.

- Clean Renewable Energy Bonds (CREBs) (Federal), 26 USC § 54C, IRS Notice 2015-12.

- Energy Efficient Commercial Buildings Tax Deduction (Federal), 26 USC § 179D, H.R. 2029, enacted December 18, 2015.

- Low Income Home Energy Assistance Program (LIHEAP) (Federal), 42 USC § 8621, et seq.

- Power Project Loan Fund (State), Alaska Energy Authority program, AS § 42.45.010, Enacted 1993.

- Qualified Energy Conservation Bonds (QECBs) (Federal), 26 USC § 6431, IRS Notice 2012-44, effective date: July 9, 2012.

- Renewable Energy Grant Program (State), A.S. 42.45.045, enacted May 22, 2008.

- Renewable Electricity Production Tax Credit (PTC) (Federal), 26 USC § 45, H.R. 2029, enacted December 18, 2015.

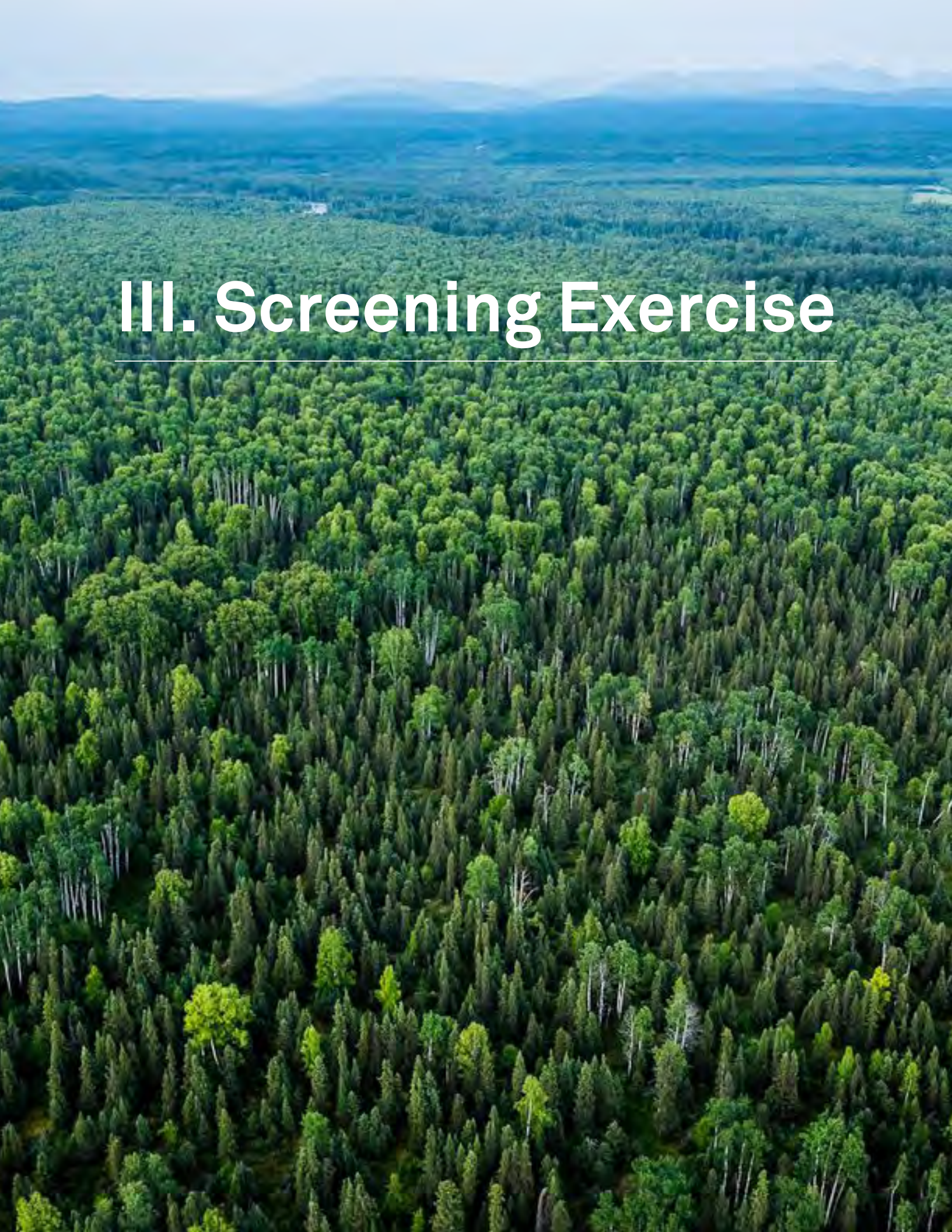
- Residential Energy Efficiency Tax Credit (Federal), 26 USC § 25C, H.R. 2029, enacted December 18, 2015.
- Residential Renewable Energy Tax Credit (Federal), 26 USC § 25D, H.R. 2029, enacted December 18, 2015.
- Rural Energy for America Program (REAP) Energy Audit and Renewable Development Assistance (EA/REDA) Program (Federal), 7 USC § 8107, H.R. 8, Agricultural Act of 2014, enacted February 7, 2014.
- Rural Energy for America Program (REAP) Loan Guarantees and Grants (Federal), 7 USC § 8107, H.R. 8, enacted January 2, 2013.
- Tribal Energy Program Grant (Federal), 25 USC § 3501 et seq.
- US Department of Energy - Loan Guarantee Program (Federal), 42 USC § 16511 et seq., 10 CFR 609.
- USDA High Energy Cost Grant Program (grant program for rural utilities) (Federal), 7 CFR 1709.
- Weatherization Assistance Program (WAP) (grant program) (Federal), 42 USC § 6861, et seq.

Alaska Housing Finance Corporation Programs

- Building Energy Code, revised July 1, 2013.
- Energy Efficiency Revolving Loan Fund Program, AS 18.56.855, enacted June 16, 2010.
- Home Energy Rebate Program, https://www.ahfc.us/efficiency/energy-programs/home-energy-rebate/.
- Weatherization Program, AS 18.56.850, enacted 1992.

Additional Resources

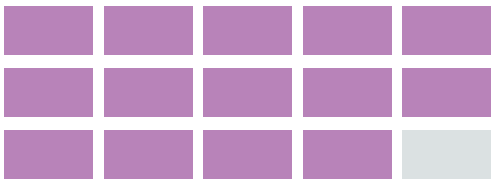
- Assorted memos compiled by the Emmett Environmental Law and Policy Clinic at Harvard on contractual terms for agreements with potential Alaska partners, including municipalities, utilities, and Alaska Native Village Corporations.



III. Screening Exercise

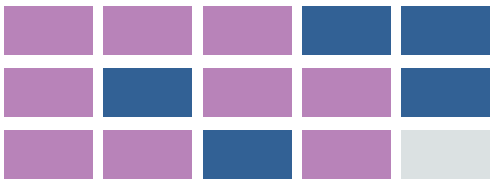
Screening Exercise

SCREENING STEPS



STEP 1

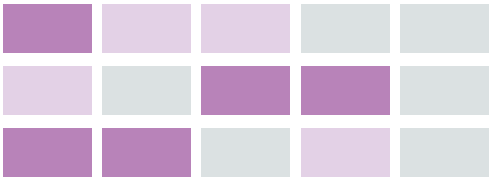
Identify 14 Projects



STEP 2

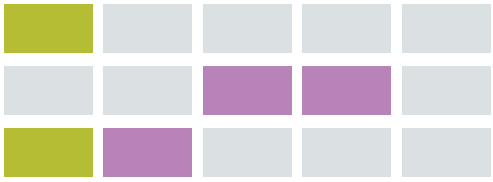
Elimination Round

Remove projects with obvious barriers



STEP 3

Combine Similar Projects



STEP 4

Screening Round

Screen projects with 8 criteria and assign Purple, Green, Red, or Blue ranking

Screening Criteria

SPECIFIC AND UMBRELLA

AVOIDED CO2

- Order of magnitude metric tons

ADDITIONALITY

- Ability to claim
- Policy
- Market
- Additionality

LEGAL

- Contracts
- Governing bodies
- Limits on procurement
- PCE program
- Tax credits
- Easements

IMPLEMENTATION

- Technical complexity
- Community support
- Public approvals
- Labor rules

HEALTH BENEFITS

- Avoided mortality
- Hospitalization costs
- Hegative health conditions prevented

OTHER CO-BENEFITS

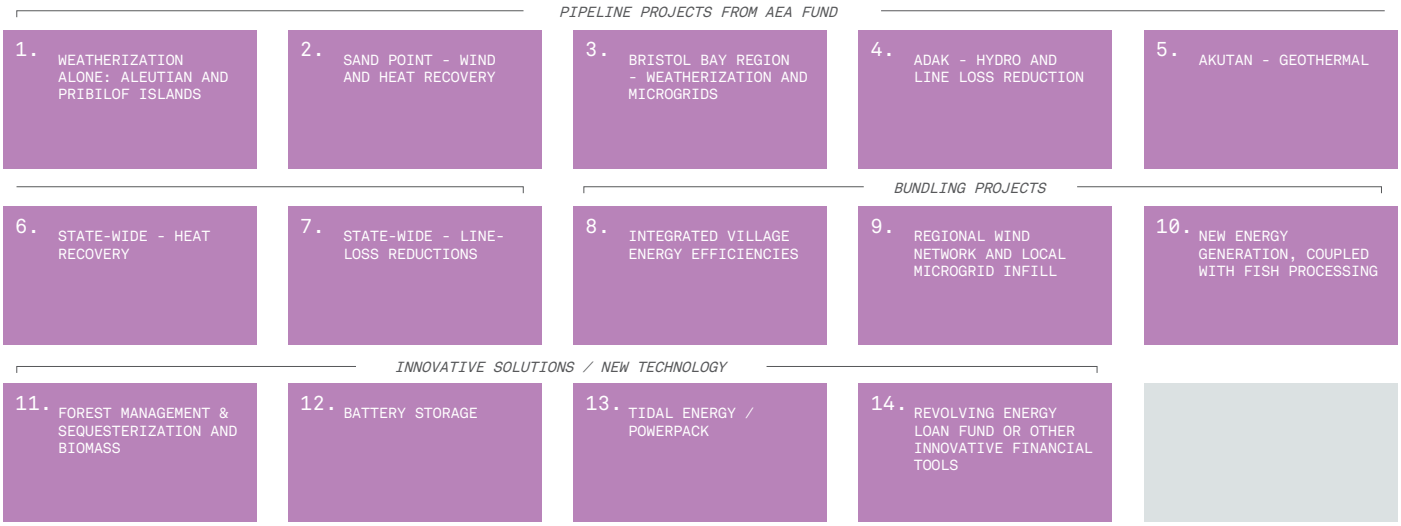
- Leverage culture and history
- Job training
- Educational opportunities
- Ecological conservation

SCALABILITY

Within Alaska

Identify 14 Projects

SCREENING STEP 1



Projects sorted into three categories: 1) pipeline projects from the AEA grant fund, 2) bundles of projects, and 3) Innovative solutions and new technology.

Eliminate Projects with Obvious Barriers

SCREENING STEP 2

PROJECT 4

ADAK: HYDRO AND LINE LOSS REDUCTION

Barriers

Not scalable because hydro capacity and lineloss are both outliers among project types in AEA funding program.

Project Summary

The Adak Hydro Power Generator, which would harness snow run-off as hydropower to displace 360 – 760 MWh of diesel energy, is not a viable project for the scope of this course. The absolute barrier preventing pursuit of the project is scalability, and there are legal concerns as well. While the hydropower potential is larger in Adak than in other comparable locations, indeed it stands out as an anomaly, the project is still significantly below present energy needs for the village of 150 people.

This project neither makes a significant carbon emissions reduction independently nor has the possibility of being implemented across Alaska to reach a larger reduction target. Lastly, possible legal barriers such as environmental flow restrictions could limit power generation and reservoir development for the project. For these reasons, we have chosen not to pursue the Adak Hydro Power Generator project beyond the first round of screening.

PROJECT 5

AKUTAN: GEOTHERMAL

hBarriers

Geothermal resources not easily replicable beyond Aleutian Islands; not scalable, project- and building-specific; if it was abundant, you would be already using; cost of exploring.

Project Summary

The City of Akutan intends to construct, operate and maintain two 5 Megawatt (MW) non-condensing steam plants, along with four production/injection wells, access roads, transmission lines and support facilities necessary to convey power to the City of Akutan and the Trident Seafoods Shore Plant, located adjacent to Akutan village. In addition, the residual steam and hot water will be used to provide facility and home heating in Akutan, also referred to as teleheating. Over 50% of the energy used in Alaska communities is for heating and electrical resistance heating and is the most expensive while use of residual hot water from the geothermal steam plants in anticipated to be cost-effective.

According to a feasibility study, a local heating district may be feasible in Akutan, routing the distribution system similarly along the boardwalk, and leveraging waste heat recovered from the community power plant generators, surplus heat available from the Trident seafood processor site, and heat from the community and Trident incinerator facilities. The study concluded that the hot springs in Akutan are a significant direct use resource.

PROJECT 7

STATE-WIDE: LINE-LOSS REDUCTIONS

Barriers

No additionality, utilities moving towards smart-meters anyway; requires regular maintenance.

Project Summary

Projects that would reduce line losses appear to offer significant opportunities for reducing the waste of diesel fuel. Line loss reflects the percent of electricity (kWhs) generated by a utility that is not sold. Line loss may be due to physical losses in the distribution network (possibly caused by deteriorating lines and old or under-sized transformers) or unmetered use. The result is a direct financial loss to the utility and waste of thousands of gallons of diesel fuel per year. Line loss also affects the PCE rate available to a utility; losses above 12 percent reduce the PCE subsidy.

The recent Alaska Energy Authority report laying out an "Alaska Affordable Energy Strategy" found that renewable energy generation opportunities in the state are very site-specific and limited by local resources and the economy of scale. The report also found that the most significant opportunity for cost savings in electricity generation and distribution is in reducing distribution line losses.

PROJECT 10

ENERGY GENERATION, COUPLED WITH FISH PROCESSING

Barriers

No established evidence on the emission savings. Replacing traditional diesel with fish oil may be considered as additional, but the amount of emission offset will be hard to determine.

Project Summary

Fish oil from the fish processing plants could be used as a potential resource of energy. Currently, some seafood processors have reported to be using oil from fish waste economically either in boilers or power plant generators to save the usage of diesel, including Trident Seafoods in Akutan, Alyeska Seafoods in Dutch Harbor, and Westward Seafoods.

Currently, Alaska is producing 8 million gallons of fish oil each year. The majority of these fish oil is sold as a dietary supplement to humans. However, the supply of fish oil is greater than the demand from the human consumption market, leaving a large quantity of fish oil available for fuel usage (13 million unrecovered fish oil from fish waste and small fish processors each year).

The Alaska Energy Authority and EPA has sponsored a pilot scale test of fish oil biodiesel, but encountered some technology difficulties that resulted in failure of the test. Specifically, fish oil biodiesel is found to

oxidize more quickly and damage the engine's fuel handling system. However, years have passed and current technology advancements may have already overcome this technical barrier.

PROJECT 13

TIDAL ENERGY

Barriers

Not a commercialized technology.

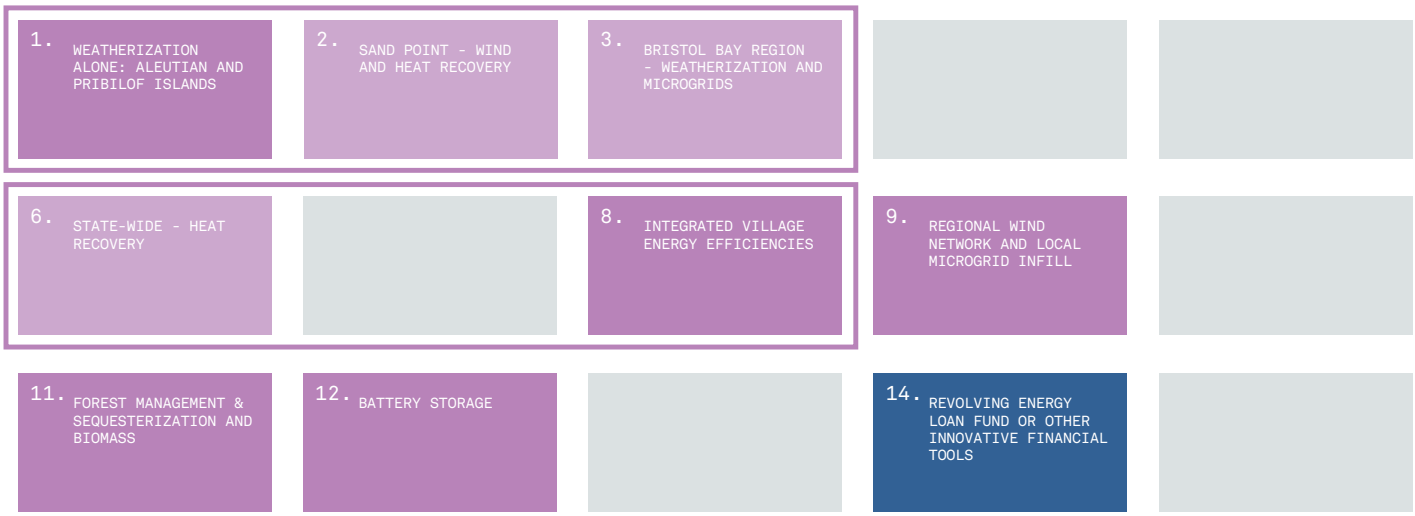
Project Summary

Hydrokinetic energy is an emerging technology with no turbines currently commercially available.. For additionality purposes, a successful hydrokinetic project would be an absolute home run. There are different challenges for hydrokinetic turbines in salt water versus in fresh water. The fresh water systems are potentially more scalable in the Alaskan context than the salt water systems, which appear to depend upon well-placed lagoons adjacent to communities. We have two resources made available to us which touched upon the potential for tidal energy.

The Aleutian Pribilof Regional Energy Plan expresses the possibility of using tidal energy for electric generation in False Pass, Nelson Lagoon, and other communities, but find that it is still a pre-commercial technology and "not appropriate technologies for isolated communities at this point". There are no commercially available devices available. The benfit is that it presents a predictable energy source. The ocean environment is particularly challenging given the corrosive effects of sea water and the logistical challenges in deploying devices.

Combine Similar Projects

SCREENING STEP 3



Project 14 should not be screened, since it, on its own, does not utilize the full capability of the team as a whole, but it will be explored as part of the feasibility analysis for implementing other projects.

Project 1 Evaluation

WEATHERIZATION ALONE

PROJECT GOALS

- IN ACCORDANCE WITH THE REGIONAL ENERGY PLAN, WEATHERIZE ALL RESIDENCES IN THE REGION
- IMPROVE SPACE HEATING IN PUBLIC AND RESIDENTIAL BUILDINGS THROUGH HEAT PUMPS AND EXPLOITATION OF EXCESS ELECTRICITY FROM HYDRO / VWIND ENERGY SYSTEMS

PROJECT SUMMARY

Phase II of the Regional Energy Plan for the Aleutian & Pribilof Islands details community profiles and energy profiles for each town in the islands. The total population of the region is about 9000, with approximately half residing in Unalaska, the largest town. Nearly all of the islands fall within the Alaska Maritime National Wildlife Refuge and Ounalashka Corporation is the Alaska Native Corporation. Space heating costs represent 80% of home energy budgets in Alaska and 55% of energy costs for commercial buildings.

The Energy Plan identifies both space heating and weatherization as key components for maximizing energy efficiency. The Home Energy Rebate program refunds homeowners for recommended upgrades for low-income houses, but has only been exploited by 12 homes, with an average energy savings of 31% and fuel savings of 462 gallons fuel oil/year. The Aleutian Housing Authority (AHA) performs weatherization projects, spending up to $30,000 per home; residents and communities pay nothing to participate and 245 homes have done so since 2008. AHA may augment weatherization funding with federal monies and NAHASDA grants. As a whole, weatherizing the region would save about 89,000 gallons of heating fuel.

In communities with excess electricity from renewable systems or from public buildings, the Energy Plan recommends piping the heating into residential structures. Recovered heat is already exploited in Unalaksa and St. George.

There does not appear to be a significant cost deterrent for homeowners in the region to pursue energy efficiency and weatherization programs. However, uptake has been fairly limited. While information regarding heat pumps is somewhat limited, it appears that recovered heat is already being exploited in the largest community, Unalaska.

SCREENING

Avoided CO_2

Results in 890 tons of CO2 avoided and should be combined with other projects to maximize reductions.

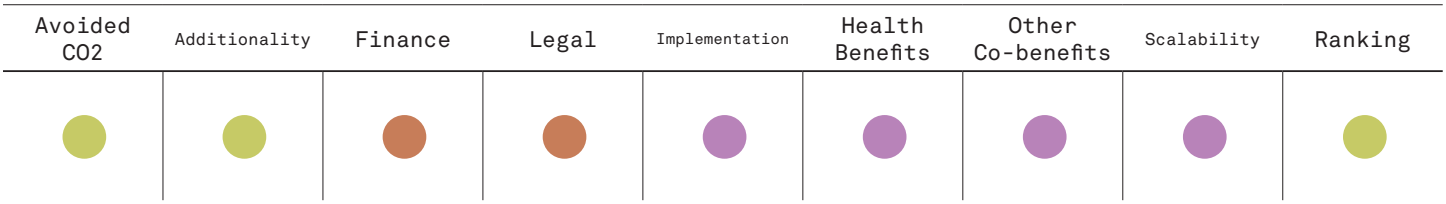
Additionality

Since this program targets on low-income households who would likely never have the resource to weatherize their houses by themselves, the program is likely to be additional.

Finance

Any public funding for improvements would require legislative or executive action - a lengthy process. From

SCREENING CRITERIA



a private funding standpoint, there is likely to be a challenge finding large enough investments in debt.

Legal

Any efficiency requirements for certain public buildings may limit additionality, but not so for residences. no absolute limits on procurement. PCE program limits the financial incentive for homeowners.

Implementation

Since the program phase i has already been implemented and no public objection has been observed, there shouldn't be much barrier to implement the program as long as the funding is available.

Health Benefits

Reduced indoor thermal stress on occupants; reduced asthma-related healthcare and costs; improved ventilation, decreased moisture, and improved lighting can improve indoor environmental quality.

Other Co-Benefits

Education and engagement; economic growth and investment in public services from energy savings; job training for residents.

Scalability

Replicable across many similar villages in Alaska.

OVERALL RANKING

Many reservations with respect to offsets, additionality, and financing.

Project 8 Evaluation

REGIONAL WIND NETWORK AND LOCAL MICROGRID INFILL

PROJECT GOALS

- COMBINED IMPROVEMENTS IN GENERATION, STORAGE, DISTRICT HEATING, AND HEAT RECOVERY.
- FOCUS AT SYSTEM SCALE: PUBLIC FACILITIES, HOUSING AUTHORITIES, ETC.

PROJECT SUMMARY

Integrated village efficiencies offer an exciting way forward to address multiple community needs: residential / commercial / government electricity, transportation, heating, and storage. Utilizing the village as a system can leverage implemented technologies with existing technologies to maximize benefits to the community. Integration provides solutions to typical issues associated with intermittent energy sources - excess energy could be stored in electric vehicles or power a larger community building that has higher demand during the day but no need for energy in the evening. There are many creative possibilities for implementing integrated village efficiencies.

Current heat recovery proposals have focused on collaborating with major utilities and recovering excess heat from utility power plants. They have the potential to offset a significant amount of heating oil, but unfortunately the design of the projects demonstrates marginal economic value. Possible cost savings measures exist at the design phase, which needs to be revisited. The Wales Water System Heat Recovery proposal to REF Round 9 demonstrates the best economic value of any of the heat recovery applications and could be used as a template for the redesign of the other heat recovery plans. The four proposed projects would displace 360 MT of CO2 emissions, so heat recovery would need to be deployed with other major sites of generation to make it worthwhile with our 50,000 MT of CO2 emissions goal.

New heat recovery projects could be implemented in tandem with renewable energy installations. It is not clear how much energy could be saved with heat recovery at sites of renewable energy generation at this time, but it would be dependent on size and location of the installation system. Design barriers are the biggest concern with this project, as the Alaska Energy Authority only suggested partial funding for the design phase for three of the four projects to help reduce their costs. It's not clear if the needed adjustments have been made to make this a viable project in the immediate future.

SCREENING

Avoided CO_2

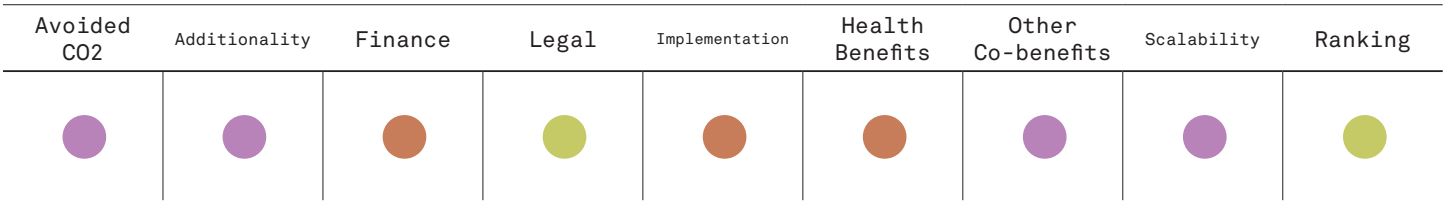
Suite of options would reduce at least 6,000 MT of CO2 in the region and could be expanded to increase reductions.

Additionality

Since this program involves many different projects, the additionality of each project depends on the design and requirement of each project.

Finance

SCREENING CRITERIA



Any insufficient in size to attract private capital because of the required ROIC. if sufficient scale can be achieved through a guarantee of large enough project(s) municipal governments may be able to attract private capital.

Legal

Any efficiency requirements for certain public buildings may limit additionality, but not so for residences. no absolute limits on procurement. PCE program limits the financial incentive for homeowners.

Implementation

Resource intensive, low offset returns, complicated property rights issues, need for technical expertise.

Health Benefits

Reductions in co-pollutant emissions would decrease exposures to outdoor air pollution and could reduce risks of cardiovascular disease, chronic and acute respiratory illnesses, lung cancer, and preterm birth.

Other Co-Benefits

Education & engagement; integration of art with installations; economic growth and investment in public services from energy savings; job training for residents.

Scalability

Replicable across many similar villages in Alaska.

OVERALL RANKING

TBC

Project 9 Evaluation

INTEGRATED VILLAGE ENERGY EFFICIENCIES

PROJECT GOALS

- BUILD TRANSMISSION LINES TO INTERCONNECT EXISTENT WIND SYSTEMS WITH ONE ANOTHER AND WITH OUTLYING COMMUNITIES.
- SUPPLEMENT THE NETWORK WITH ADDITIONAL WIND SYSTEMS WHERE NECESSARY.

PROJECT SUMMARY

For relevant areas, this project would support transmission lines to form aregional wind network, as well as additional small wind systems. There are 27 wind installations operating in rural communities outside of the rail belt. The western and coastal portions of the state have the best wind resources, but wind speed is low in the interior and the South West receives extreme gusts and turbulence.

The area with the greatest potential for connecting a number of small wind systems is in the area west of Bethel (the Yukon-Kuskokwim Delta), served by the Alaska Village Electric Cooperative (AVEC). There are already a number of wind generators in the area, but they do not appear to be connected. AVEC sumitted a project proposal to the Renewable Energy Fund for a short (a few miles) intertie program to connect an outlying village to the St. Mary's wind system. The transmission project is along a road and involves no easements or state permits. The project has been in planning for over 10 years and costs a couple million of dollars.

The Yukon-Kuskokwim Delta is comparable in size to the state of Louisiana, is mostly tundra, and is part of the Yukon Delta National Wildlife Refuge. Bethel is the hub, with 6,219 residents and the delta has a total of 25,000 residents, 85% native and 30% well below the poverty threshold.

It appears that the area with the greatest wind potential is already being exploited by ALEC, which has proposed a multi-billion dollar gas plant on the North Slope and long transmission lines to the region already. Transmission lines cost between $200,000 and $2,000,000 per mile. Low usage and long distance make the construction of transmission lines cost-prohibitive. The AEA Rural Village Transmission Screening Study from 2009 found transmission connections either from diesel or wind projects to be cost prohibitive for every village-to- village connection in the Bethel region.

.

SCREENING

Avoided CO_2

Wind network in St. Mary's - Pitka Point would result in 1,000 MT of CO2 reduced and could be scaled to increase reductions.

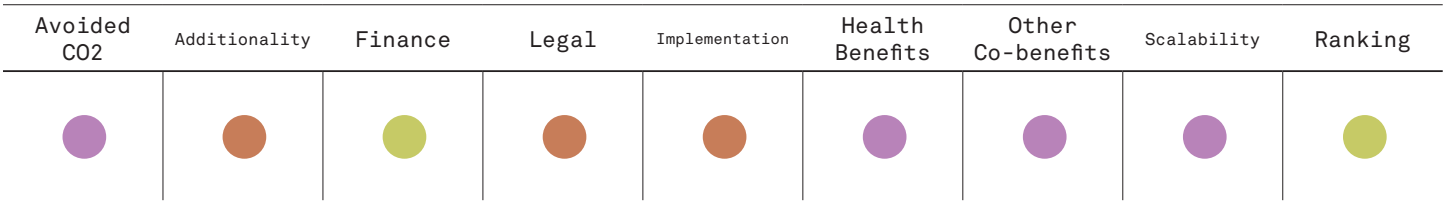
Additionality

Do the wind farms that are being connected claim the additionality or do the transmission line builders claim the additionality? If state has RPS, wind to meet regulations can't claim additionality.

Finance

Easier to secure private capital to support large-

SCREENING CRITERIA



scale microgrid projects through social enterprise / environmental funds that have guarantee from municipal/state governments.

Legal

House Bill 306 established aggressive renewable goals, although there is not yet a specific requirement for utilities. This suggests potential additionality problems under the VCS protocol.

Implementation

It will be very hard to build a transmission line across properties, because it will raise major disputes on property rights and incur high transaction costs.

Health Benefits

Reductions in emissions would decrease exposures to outdoor air pollution and could reduce risks of cardiovascular disease, chronic and acute respiratory illnesses, lung cancer, and preterm birth.

Other Co-Benefits

Economic growth and investment in public services from energy savings; job training for residents.

Scalability

Replicable across many similar villages in Alaska.

OVERALL RANKING

Resevations with respect to house bill 306 and property rights issues; if state has rps, then wind cannot claim additionality.

Project 11 Evaluation

REGIONAL NATIVE CORPORATION FOREST SEQUESTRATION

PROJECT GOALS

- SEQUESTER CARBON THROUGH CONSERVATION EASEMENTS IN TRIBAL CORPORATION FORESTS.
- SUSTAINABLE FOREST MANAGEMENT TO PROVIDE BIOMASS FOR PUBLIC FACILITY BOILER SYSTEMS.

PROJECT SUMMARY

The Alaska Native Claims Settlement Act of 1971 (ANCSA) has divided the Alaskan homeland into 12 regional corporations that own a total of 44 million acres of traditional homeland. Each of these regional corporations own a certain amount of land and some of them contain old growth forests. The ones that own forest land all have their own forest management and conservation requirements, and are open to opportunities for carbon sequestration or biomass harvest.

Therefore, this project is likely receive community support as long as it obeys the forest management requirements of each Native Corporation. Financially, it might be easier for us to negotiate a lower price of biomass resources from these native corporations than those from private or national land owners, because they own a large amount of biomass resource and the forest management requirements might be less stringent than national forests. Environmentally, sustainably harvesting biomass from old growth forests should not reduce the growth rate of the forest. However, the transportation of biomass and the use of diesel chainsaws may generate additional scope 3 emissions.

Another downside of this project is that it may face much political pressure because the local government would try to harvest the mineral resources underneath these native lands. Also, among the 12 Native Corporations, only four of them have forest land, which means this resource will not be able to cover a large area of energy needs.

Barriers: no absolute barrier, but there are only a few native corporations with forest land, which means biomass energy can only be provided to a limited number of villages. Claiming carbon sequestration from these forests, however, could be a potential project, because carbon sequestration from well managed forests can be claimed as offsets, and can be traded in the national or regional markets.

SCREENING

Avoided CO_2

Emissions reduction is unclear at this point; will depend on forest management techniques and # of acres set aside.

Additionality

Carbon sequestration from privately owned forests likely to pass additionality, because the forest would have been exploited for other purposes if not protected.

Finance

If negotiated through Native corps, biomass fuel could be cheap and abundant. However, it is unclear what the cost of biomass boilers is and where the capital investment for these will come from.

SCREENING CRITERIA

Avoided CO2	Additionality	Finance	Legal	Implementation	Health Benefits	Other Co-benefits	Scalability	Ranking
								

Legal

Chugach Alaska Corp deal transfers offset rights to new Forests, which retires them to the nature conservancy. legal backing is there. Alaska law establishes a broad right for conservation easements.

Implementation

Local governments may not support such program because they hope to explore the underground mineral resources within these lands.

Health Benefits

Local governments may not support such program because they hope to explore the underground mineral resources within these lands.

Other Co-Benefits

No obvious co-benefits are clear at this point.

Scalability

Limited scale due to limited number of forest management partners and finite number of forest acres; but may offer large amount of offsets in comparison to small-scale projects.

OVERALL RANKING

Passes additionality and offers potential for larger bundles of offsets.

Project 12 Evaluation

BATTERY STORAGE / POWER PACK

PROJECT GOALS

- SPECIALIZED BATTERIES INTEGRATED WITH RENEWABLE ENERGY SOURCES TO STORE EXCESS POWER GENERATED SO THAT IS IT NOT WASTED

PROJECT SUMMARY

Tesla has begun manufacturing specialized batteries that can be integrated with renewable energy sources to store excess power generated so that is it not wasted. Well-suited for renewable energy based microgrids, These batteries can be for commercial/ utility use ("Powerpack") or residential ("Powerwall"). Powerpacks are "capable of powering up to 15,000 homes for four hours during peak times, or roughly 2,500 homes for an entire day."

Low implementation time – went from concept to installation in Southern California project ("Edison's Mira Loma substation") in under six months. Including three months of actual construction time needed to pour a concrete pad, and then it's "plug and play." Tesla is establishing a pattern of partnering with utility companies to provide powerpack-based storage stations to supplement existing grid infrastructure. Part of the rationale for the Tesla-Solar City merger IOT expedite regulatory challenges. Tesla continues to reduce price to increase affordability – currently selling for ~$400/kWh of storage.

Applicability in Alaska:

- Could be used to ensure there is sufficient energy for microgrids in rural communities using wind/ solar for power generation;
- Microgrids are localized, can use renewable energy, reduce dependence on fossil fuels (i.e. diesel);
- Need to know how reliable and what the duration of storage capacity is;
- Works well for a wind turbine/solar field that stores during the day and can utilize the electricity at night;
- What about a region that produces solar energy for ~6 months and then is dark? How long can battery retain the stored electricity?;
- Tesla/Solar City seem like they would be interested in partnering with utilities;
- This could scale across multiple communities in Alaska - Would they be willing to reduce prices or amenable to creative financing options if the State can guarantee a certain volume of sales?

SCREENING

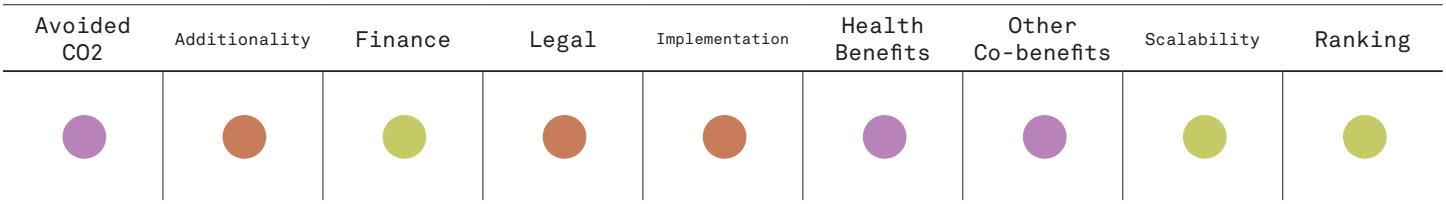
Avoided CO_2

Green light if it is combined with village efficiency option.

Additionality

This project has to be coupled with another entity, such as a renewable energy producer, utility company, or a home owner. Who shall claim the additionality?

SCREENING CRITERIA



Finance

There is not enough evidence that the State can co-invest with utility companies in projects that match renewable energy generation with storage capacity.

Legal

House bill 306 established aggressive renewable goals, although there is not yet a specific requirement for utilities. This suggests potential additionality problems under the VCS protocol.

Implementation

The installation of powerpacks require land, transportation and certain climate to maintain the battery life, which may be a problem for Alaska.

Health Benefits

Excess energy storage can displace additional burning of fossil fuels, which can then lead to reduction of air pollution and ultimately of respiratory and cardiovascular diseases.

Other Co-Benefits

Economic growth and investment in public services from energy savings; job training for residents.

Scalability

Scalable if transition system exists and other technology concerns are addressed.

OVERALL RANKING

This option should be combined with the integrated village efficiency option.

Climate Solutions Living Lab | Harvard Law School | May 8, 2017