Feasibility for Wood Heat

Collaborative Integrated Wood Energy Program for Yukon Flats Villages

DOE Tribal Energy Program

20 November 2008

Council of Athabascan Tribal Governments (CATG)

- Non-Profit Consortium of Ten Tribal Governments within the Yukon Flats.
- CATG Administers several Tribal Programs on behalf of the Tribes.
- CATG also applies for and administers several other grants.
  - **IHS**, Regional Clinic (Fort Yukon), Health Aids in Each Village, drug and alcohol programs, and other health related programs.
  - **Natural Resources**, EPA/IGAP, ANA (Traditional Land use Planning and Mapping), GIS, USDA RC&D, Contracts/Compacts with the USF&W (first tribal entity in U.S.), and many other NR related projects.
  - **Education**, NACTEC, NAVTEP, Early Head Start, Facilitate/Cooperate with UAF on other education programs.

Gwichyaa Zhee Gwich'in Tribal Government (GZGTG)

Federally recognized tribe 1200+ Tribal Members. Administers all 638 tribal programs and many other grants to include:

Natural Resources, Realty, ICWA, General Assistance, Education/Employment, Elders Nutrition, Forestry, Fire Management, Self-Governance, Economic Development, Tribal Operations, EPA/IGAP and many other programs and grants.

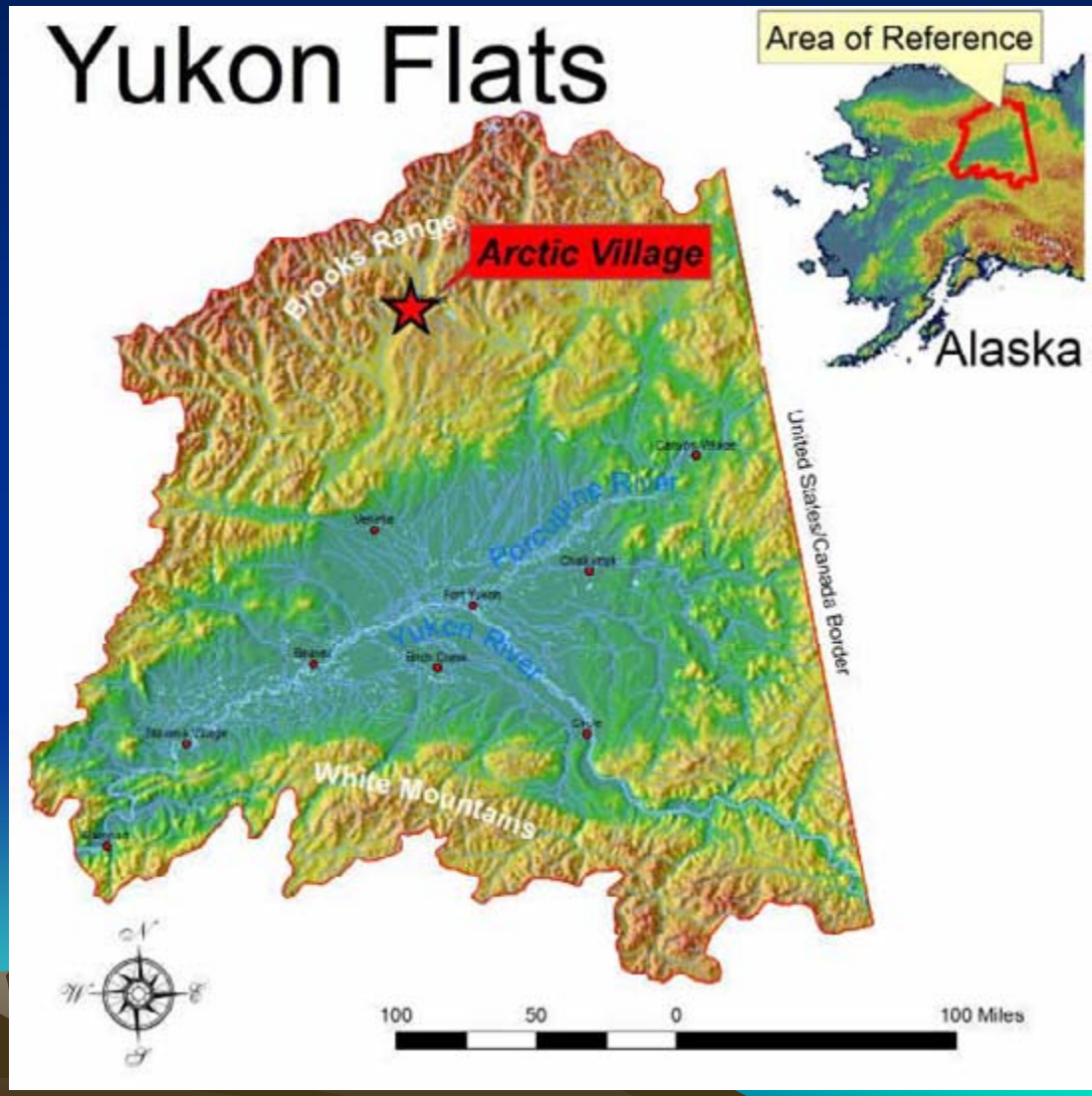
Gwitchyaa Zhee Corporation (G.Z. Corporation)

For-profit organization formed under the Alaska Native Claims Settlement Act (ANCSA) 1971. G.Z. is the village corporation, under ANCSA they also created 13 Regional Corporations, ours is Doyon Inc. G. Z. has 600+ shareholders, not all tribal members are shareholders, because the corporation hasn't voted to enroll children born after 1971.

Some of the economic projects the corporation has:

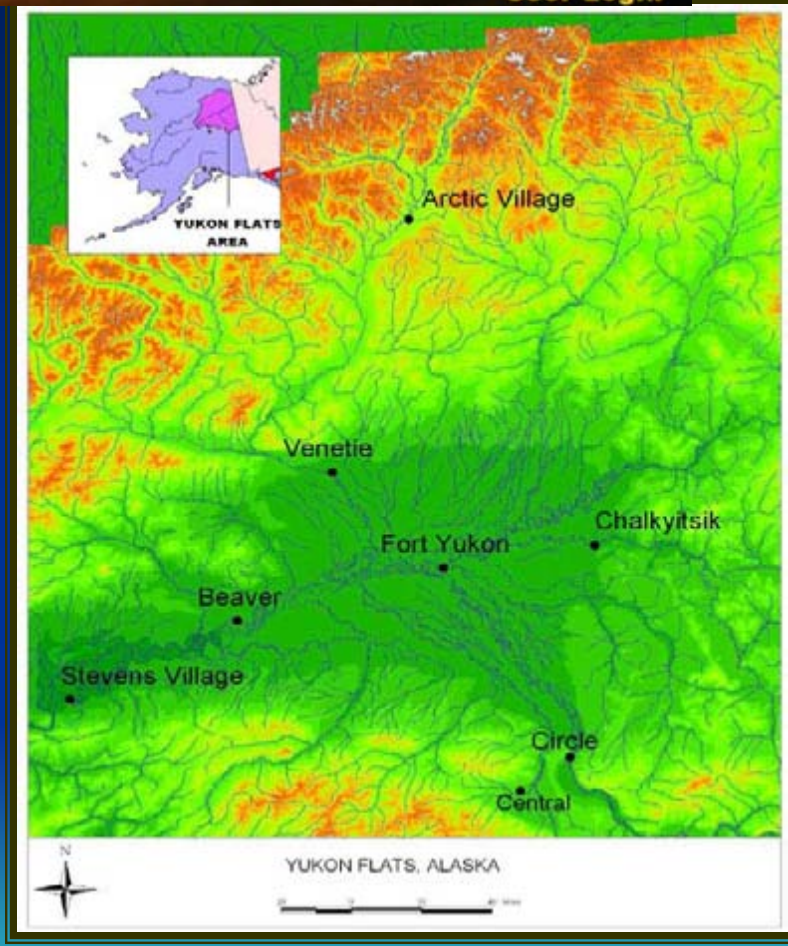
Fuel Station, rental buildings, land leases, 7i funds, mutual funds, gravel sales, timber sales, and hopefully Bio-mass.

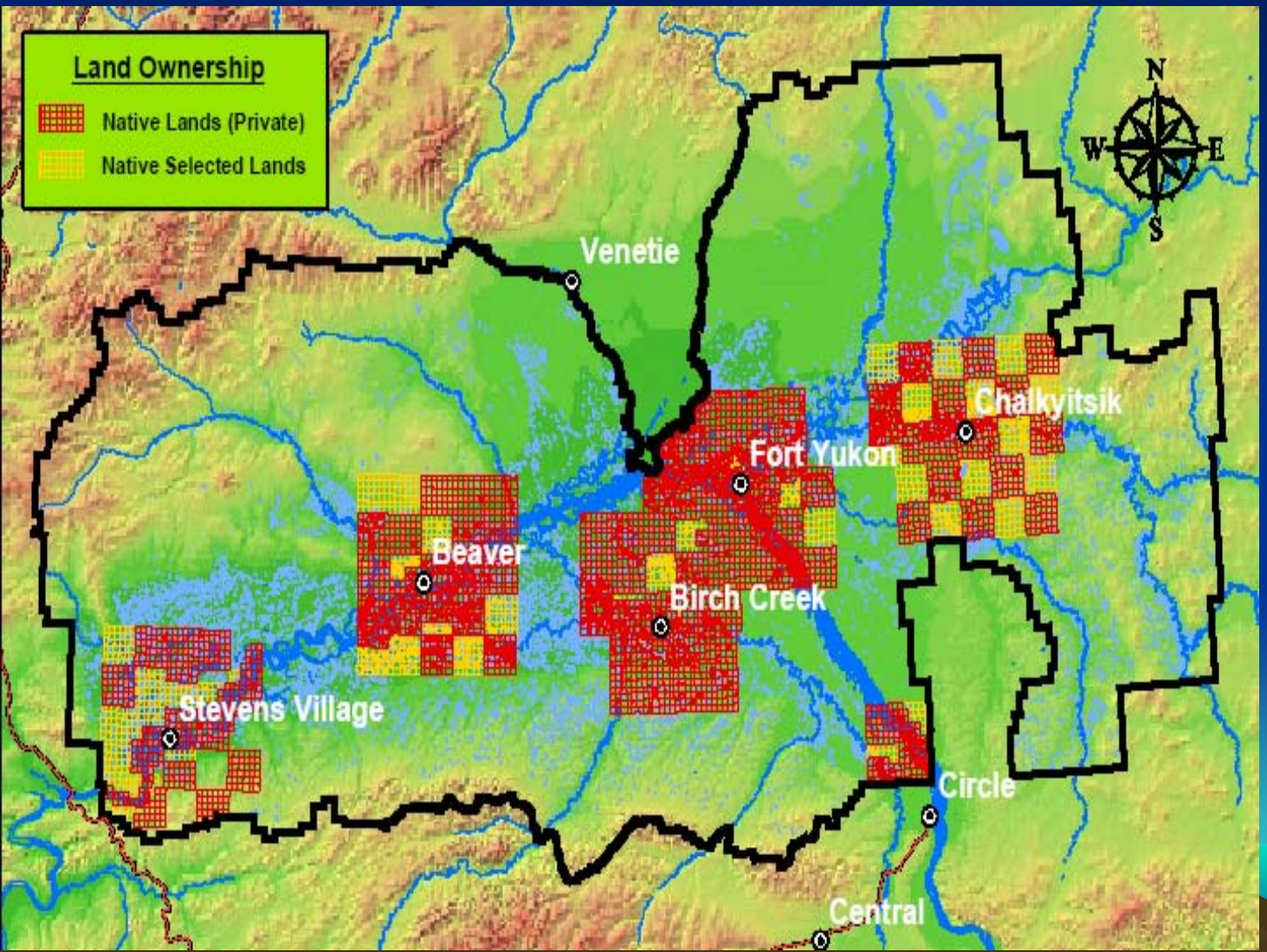
- 10 Athabascan villages in Yukon Flats
- 8 Gwich'in villages and 2 Koyukon villages.
- 55,000 sq. mi. Size of Wisconsin.
- 1500 people
- Fort Yukon largest Hub Village 650 people.
- Smallest Village Birch Creek 25 people.
- Fort Yukon and Circle are the only Villages with a City Government.
- There is no organized Borough in the Yukon Flats.
- Only one village on road system.



- All electricity is generated by diesel.
- 4 villages have to fly fuel in, no barge service.
- 2 villages cut their generators off at 10 pm and back on again at 8am. Venetie and Arctic Village.
- One Village has Pre-paid Meters. Chalkyitsik
- 80% of homes in Fort Yukon are heated by wood. Most use wood and fuel heat.
- All other villages heat by wood with a few that use fuel. All Village buildings are heated by fuel.
- Fort Yukon is only village that has piped water and is currently installing piped sewer.
- Chalkyitsik and beaver has some piped water and are developing septic tanks. All other villages have to haul own water and use honey buckets and outhouses. All Village Schools have running water and sewer.
- All villages have a washeteria where they get their water, shower, and wash clothes.

- Fuel cost in Fort Yukon $7.00 gal.
- Fuel Cost in Arctic Village $14.00 gal.
- Some of the alternative energy programs Fort Yukon has looked at:
- Wind, not Feasible only 7mph
- Hydro, not enough stream flow maybe as technology advances, pilot project in eagle.
- Solar, we have two projects one in Fort Yukon on a Elders building and one in Arctic Village on their water treatment plant. Between May and August we have 24 hours of daylight, so we need to look at more solar projects.
- No geothermal, Stevens Village has a Hot Springs but too far away.
- Coal Bed Methane, not giving off enough methane.
- Oil/Natural Gas, Alpine Size Oil Field and 83,000,000 cu.ft. Natural Gas, but Villages/Residents are opposed to drilling.





- Fort Yukon Received 226,000 acres Under ANCSA.
- Checker boarded with lands owned by Doyon Regional Corporation.
- Venetie/Arctic Village didn't participate in ANCSA and they claimed 1.9M acres which they thought was a reservation, but own land in fee.
- Within the Yukon Flats National Wildlife Refuge.
- Adjacent to Arctic National Wildlife Refuge.

Subsistence Life Styles

Subsistence Resources:

Moose, Caribou, Dall Sheep, Black Bear, Brown Bear, Wolves, Beaver, Muskrat, Otter, Fox, Salmon (Chinook, Coho, summer and fall Chum), White Fish, Sheefish, Pike, lake trout, grayling, Grouse, Spruce Hen, Waterfowl from 5 different countries, blueberries, raspberries, rosehips, wild onions, rhubarb, and many other natural resources that we utilize and depend on.

Bio-Mass is not a new concept to the Yukon Flats. We Currently Utilize wood for Heating our Homes and back in the Steamboat Days we sold cordwood to power the steamboats.

People meeting a steamboat

Old & New Housing

More info on Yukon Flats:

www.catg.org

www.fortyukon.org

Community Based Program Wood Heat Feasibility

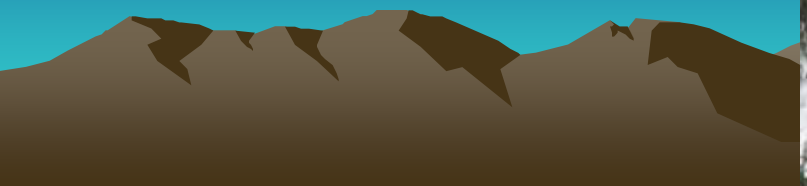
1. Assessed forests resource
2. Assessed fuels use
3. Assessed current technologies
4. Developed an integrated model

Highest energy costs in nation:
$7.00 per gallon of heating fuel
500 gal. fuel oil heat one house 3.5K
Heat School & Gym 30,000gals $210K
Run Generators = 200,000gals $1.4M

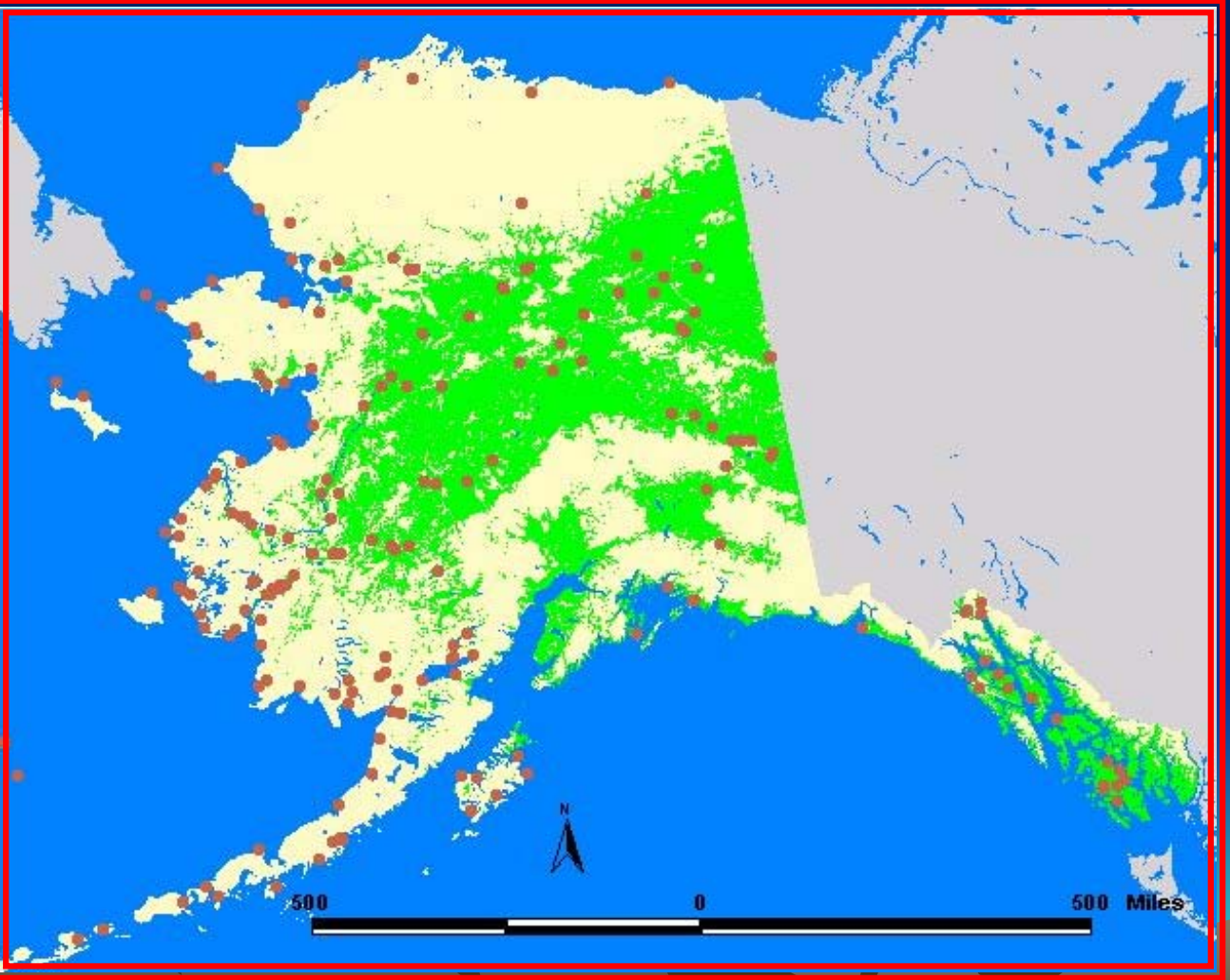
		$/MBTU
• $0.51	per kWh electricity	$149
• $6.75	per gallon gasoline	$52.70
• $7.00	per gallon heating fuel	$46.30
• $130	per 100 lb propane	$60.30
• $200	per ton wood	$17.33

Highest Energy Costs in Nation

Village Survival



Why Biomass as an Energy Source
Alaska has 1/7 of US Forest Lands



No Wind

Solar summer

No Hydro

Objective:

Displace Diesel

Wood for Heat

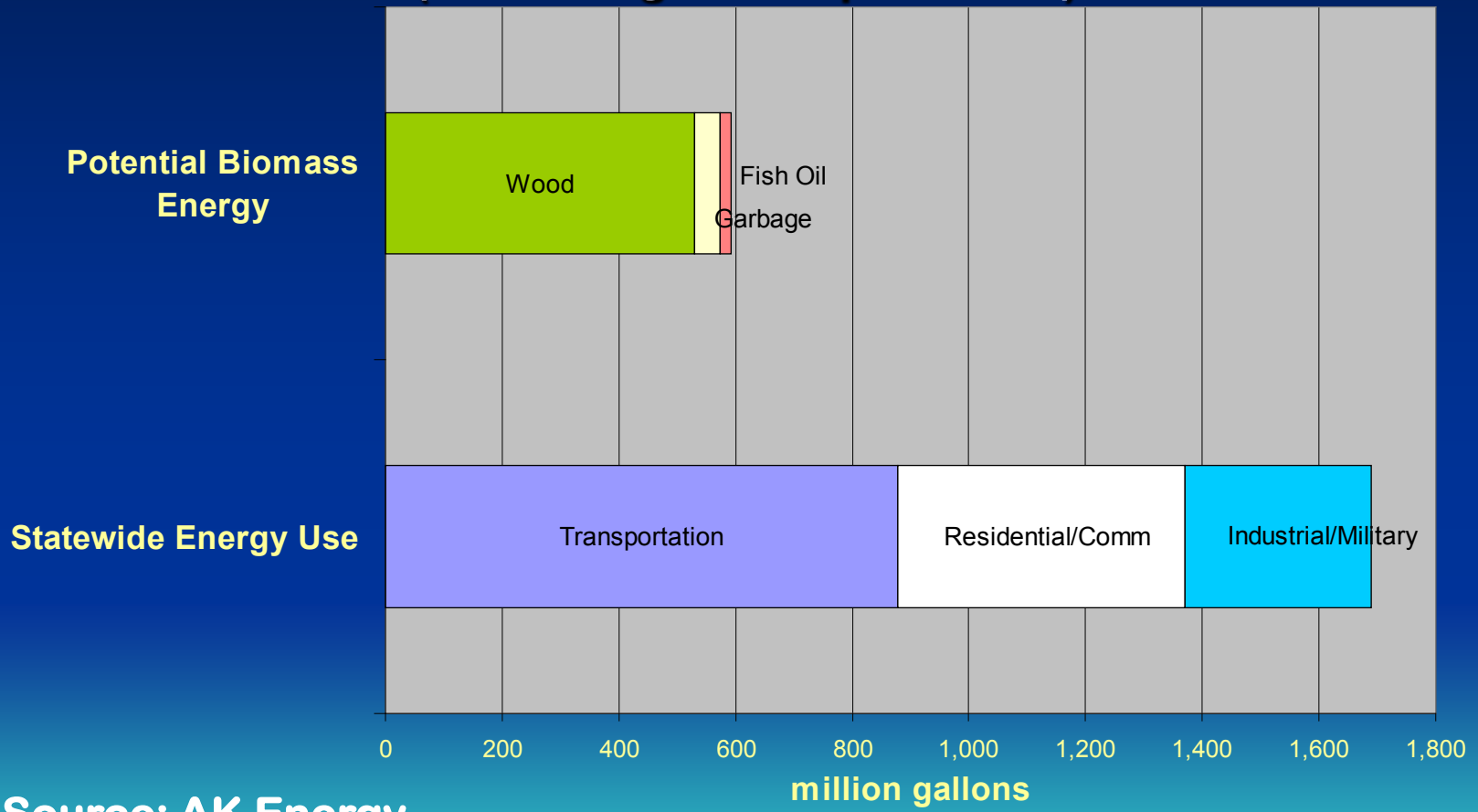
Source: AK Energy Authority

Potential Biomass Energy

vs

Actual Alaska Energy Use

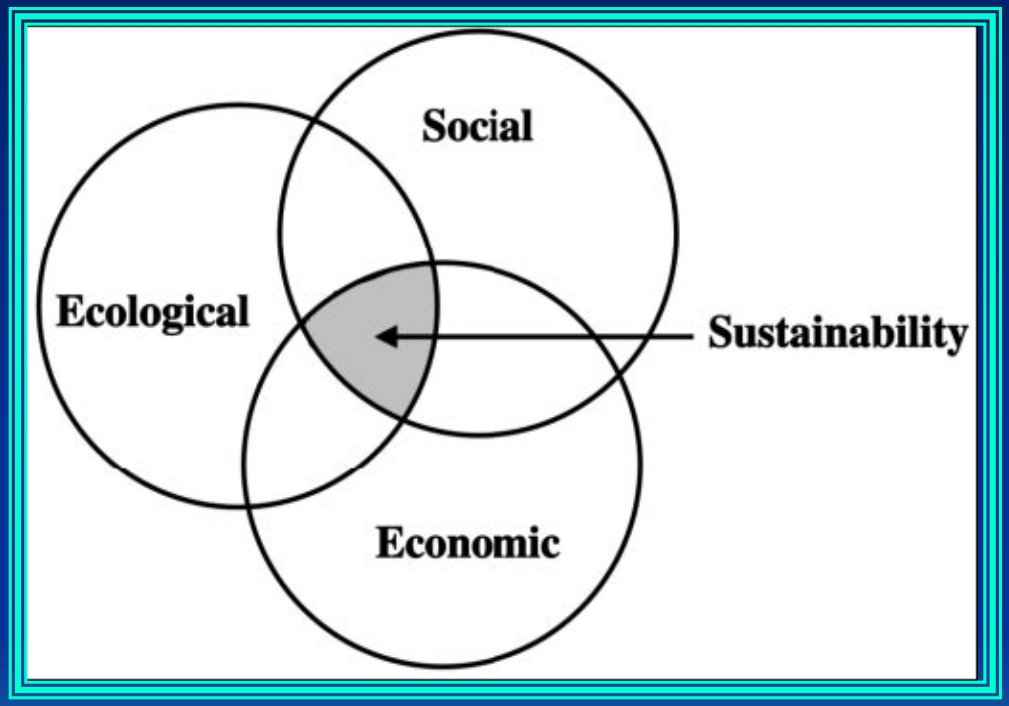
(in diesel gallon equivalents)



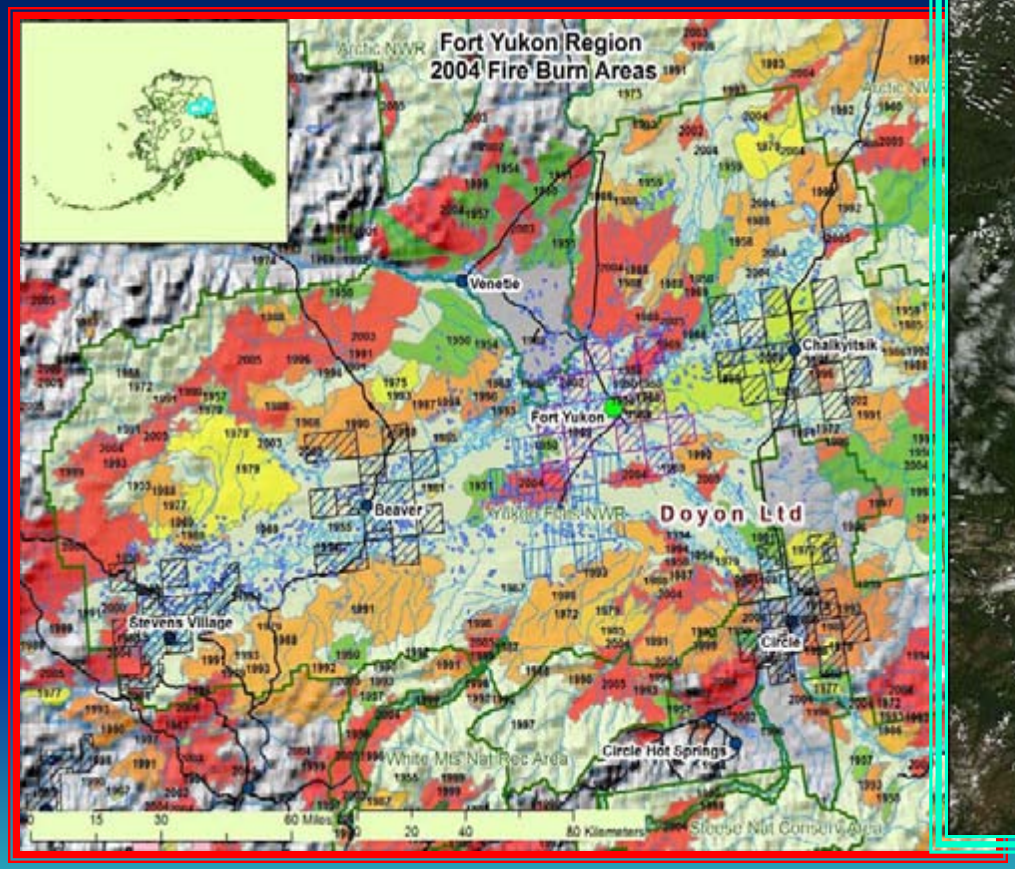
Source: AK Energy Authority

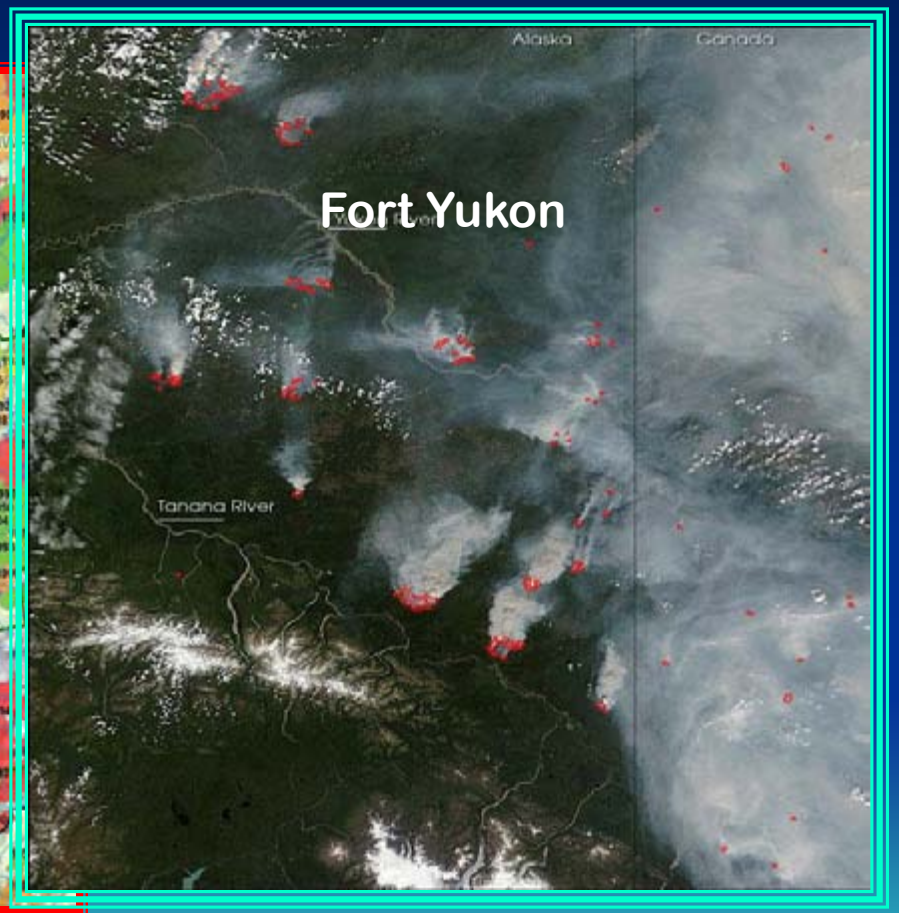
Community Based Sustainability

- **Program: economically, socially, culturally, ecologically sustainable.**



Fire Driven Ecosystem
12MM acres statewide in 2004-2005





Fires 1950-2004 **Fires in 2004**

Typical Example of Seral Stages of Black Spruce Forest in Interior Alaska

3 Years Old

15 Years Old

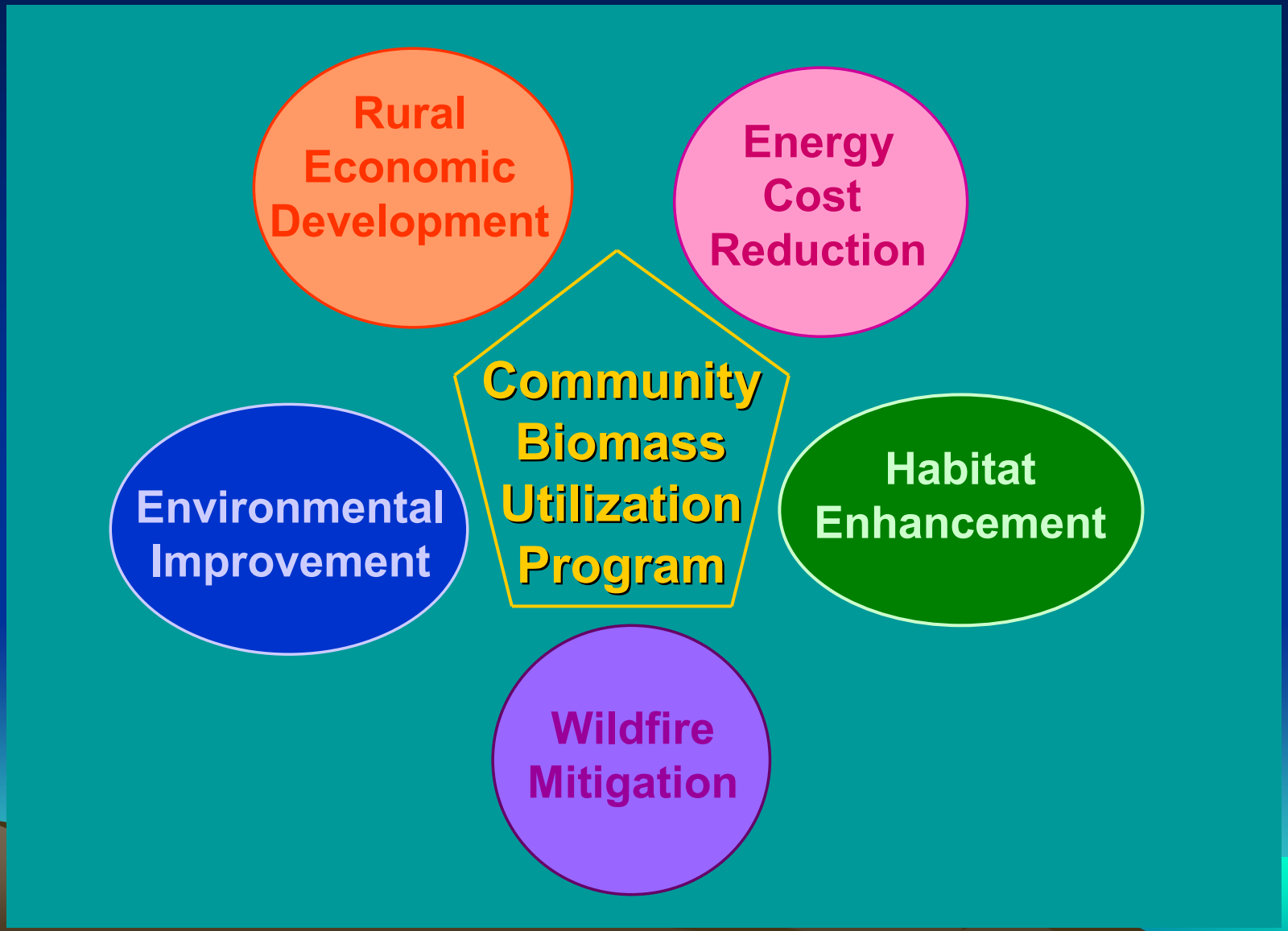
43 Years Old

81 Years Old

Displacement of Fuel Oil, Local Economic Develop, Energy Self-Sufficiency & Sustainability

Summer 2005 Porcupine
Burn 79,762-acre

Community Wood Energy Program



Wood Energy Program Scales of Penetration

- **Village scale – create a wood energy utility**
- **Commercial buildings – economic driver**
- **Households – secure relatively inexpensive consistent supply**

- **Local Management Capacity Development**

The Great Debate
Chips vs. Stick

	estimated annual oil consumption gal/yr	Net Simple Payback wood-chip fired years	Net Simple Payback stick fired years	GARN worst case burn/day
Water Treatment Facility >	6,257 >	18.7	5.7 >	2.4
Pumphouse >	24,090 >	3.3	3.0 >	3.5
New CATG Clinic >	20,000 >	4.5	3.6 >	4.0
Vocational Education >	16,000 >	5.8	4.5 >	3.3
School/Gym >	30,000 >	3.4	3.8 >	3.9
Yukon Flats Center >	8,500 >	11.1	4.3 >	3.5
(1) Neighborhood DH Plant >	10,800 >	20.8	14.8 >	2.2
CATG Main Office >	16,000 >	5.6	4.5 >	3.1
Alaska Commercial Company Store >	9,600 >	9.1	3.7 >	3.8
School District Main >	3,970 >	157.1	9.0 >	1.6
Post Office >	6,400 >	17.6	5.6 >	2.5
total >	151,617			

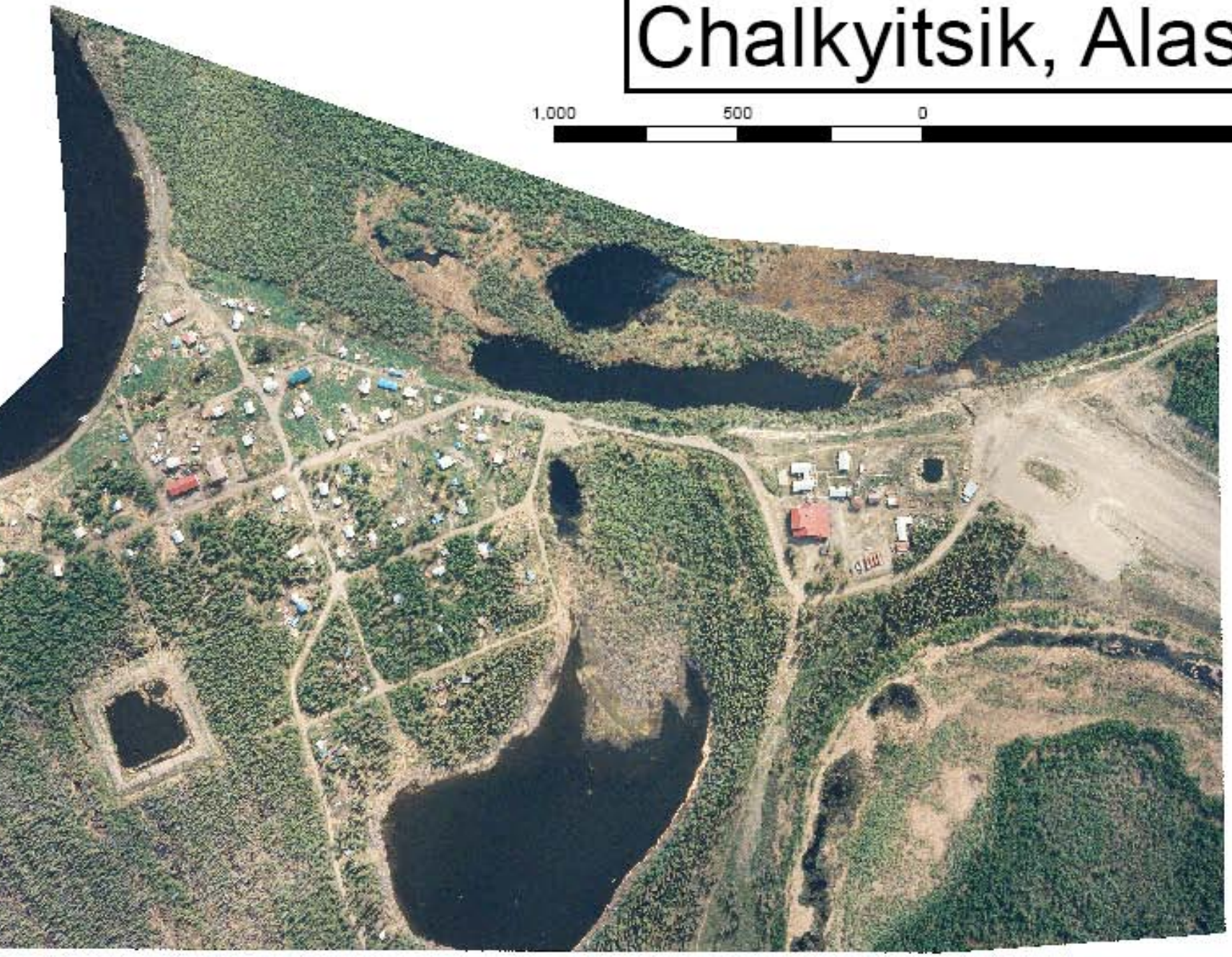
Heating Systems
Stick Fired

Heat Systems
Chip Boilers

Chalkyitsik
Wood Energy Heating Program

Chalkyitsik, Alaska

1,000 500 0 1,000 Feet



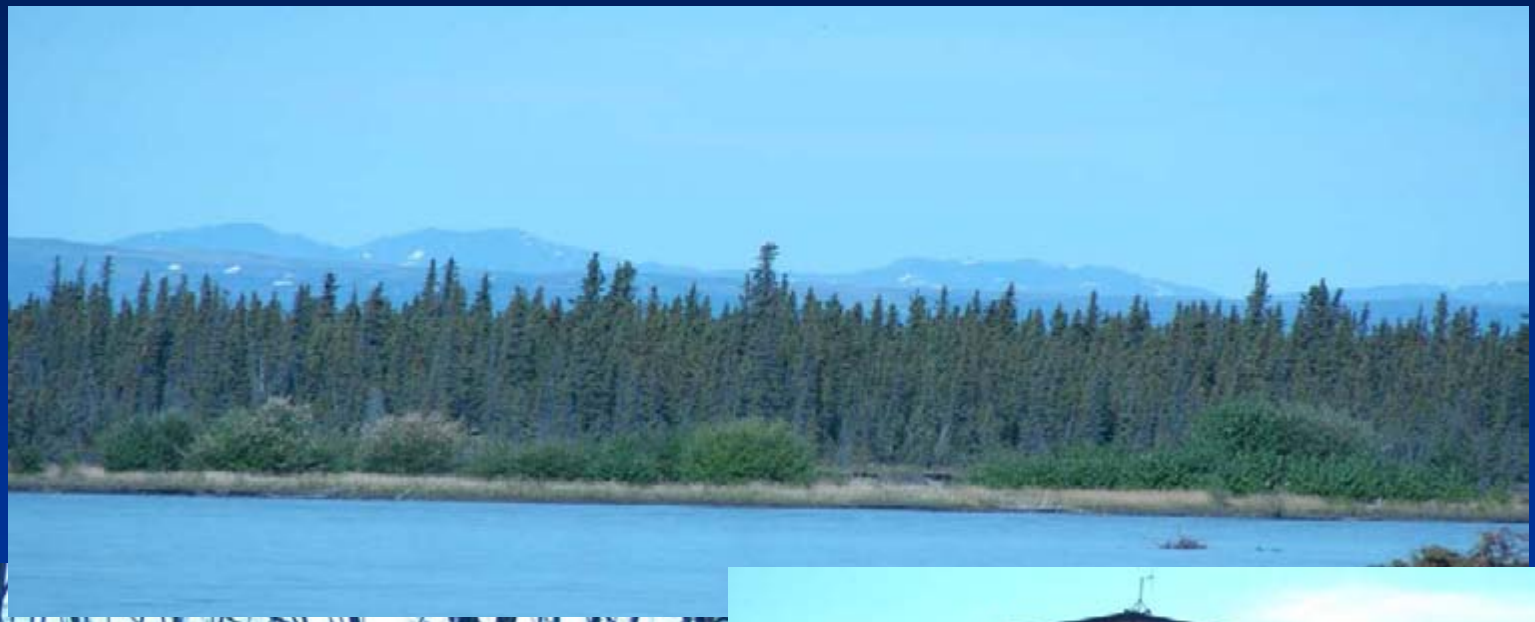
Chalkyitsik Feasibility Stick Fired

Summary of Results	School	Water Treat	Sch Housing	DH Plant	Comm CenterCC + Village Off
Stick-fired Performnace					
baseline oil consumption :	20,586	7,304	4,977	32,866	14,404	17,881
proposed biomass, cords/yr :	179	63	43	285	129	157
fraction of oil displaced :	1.000	1.000	1.000	1.000	1.000	1.000
Gam model :	WHS 3,200	WHS 2,000	WHS 1,500	WHS 3,200	WHS 3,200	WHS 3,200
No. of boilers :	2	1	1	3	2	2
Maximum wood loads per day req. :	4.0	3.8	3.9	4.0	2.7	3.2
Stick-fired Cost and savings :						
boilers, shipped and installed :	$268,221	$125,959	$118,307	$402,331	$268,221	$268,221
Slab/Building for Boilers :	$20,000	$15,000	$15,000	$25,000	$15,000	$25,000
direct buried piping :	$16,400	$16,400	$16,400	$117,650	$16,400	$58,500
interconnection :	$35,000	$35,000	$35,000	$105,000	$35,000	$70,000
other :	$15,000	$15,000	$15,000	$60,000	$15,000	$37,500
subtotal :	$354,621	$207,359	$199,707	$709,981	$349,621	$459,221
soft costs :	$112,592	$65,836	$63,407	$225,419	$111,005	$145,803
total :	$467,213	$273,195	$263,114	$935,400	$460,625	$605,023
baseline oil cost :	$164,688	$58,429	$39,814	$262,931	$115,232	$143,047
final oil cost :						
cord wood cost :	$44,853	$15,783	$10,791	$71,341	$32,222	$39,326
total savings :	$119,835	$42,646	$29,023	$191,590	$83,010	$103,721

Chalkyitsik Feasibility Chip Fired

Chip-fired Performnace						
baseline oil consumption	20,586	7,304	4,977	32,866	14,404	17,881
proposed biomass, tons/yr	235	59	11	398	165	220
fraction of oil displaced	0.769	0.543	0.155	0.815	0.769	0.829
Kob model	Pyrot 220	Pyrot 100	Pyrot 100	Pyrot 300	Pyrot 150	Pyrot 150
No. of boilers	1	1	1	1	1	1
Chip-fired Cost and savings						
boilers, shipped and installed	$228,898	$202,537	$202,537	$259,347	$216,184	$216,184
Slab/Building for Boilers	$5,000	$5,000	$5,000	$5,000	$5,000	$5,000
direct buried piping	$16,400	$16,400	$16,400	$117,650	$16,400	$58,500
interconnection	$20,000	$20,000	$20,000	$60,000	$20,000	$40,000
other	$15,000	$15,000	$15,000	$60,000	$15,000	$40,000
subtotal	$285,298	$258,937	$258,937	$501,997	$272,584	$359,684
soft costs	$90,582	$82,213	$82,213	$159,384	$86,545	$114,200
total	$375,880	$341,150	$341,150	$661,382	$359,129	$473,884
baseline oil cost	$164,688	$58,429	$39,814	$262,931	$115,232	$143,047
final oil cost	$38,031	$26,705	$33,662	$48,546	$26,669	$24,445
chip cost	$41,181	$10,315	$2,000	$69,704	$28,795	$38,562
total savings	$85,476	$21,410	$4,152	$144,681	$59,768	$80,040
Net Simple Payback						
stick-fired	3.9 yrs	6.4 yrs	9.1 yrs	4.9 yrs	5.5 yrs	5.8 yrs
chip-fired	4.4 yrs	15.9 yrs	82.2 yrs	4.6 yrs	6.0 yrs	5.9 yrs

Venetie
Wood Energy Heat Program



Venetie Airport and Washeteria

CLINIC	1500 gpy
COUNCIL	1500 gpy
TRIBAL OFF	1500 gpy
ELDERS ASSN	600 gpy

Venetie, Alaska

Venetie Feasibility Stick Fired

Summary of Results	Washeteria	School	Sch Housing	DH Plant
Stick-fired Performnace				
baseline oil consumption :	8,122	18,073	7,195	33,390
proposed biomass, cords/yr :	72	159	64	290
fraction of oil displaced :	1.000	1.000	1.000	1.000
Gam model :	WHS 3,200	WHS 3,200	WHS 3,200	WHS 3,200
No. of boilers :	1	2	1	3
Maximum wood loads per day req. :	2.8	3.5	2.6	4.1
Stick-fired Cost and savings :				
boilers, shipped and installed :	$134,110	$268,221	$134,110	$402,331
Slab/Building for Boilers :	$15,000	$20,000	$15,000	$25,000
direct buried piping :	$16,400	$16,400	$16,400	$227,500
interconnection :	$35,000	$35,000	$35,000	$105,000
other :	$15,000	$15,000	$15,000	$60,000
subtotal :	$215,510	$354,621	$215,510	$819,831
soft costs :	$68,425	$112,592	$68,425	$260,296
total :	$283,935	$467,213	$283,935	$1,080,127
baseline oil cost :	$64,976	$144,586	$57,558	$267,120
final oil cost :				
cord wood cost :	$17,991	$39,719	$16,096	$72,411
total savings :	$46,986	$104,867	$41,462	$194,709

Venetie Feasibility Chip Fired

Chip-fired Performnace				
baseline oil consumption	8,122	18,073	7,195	33,390
proposed biomass, tons/yr	78	219	62	403
fraction of oil displaced	0.648	0.816	0.582	0.813
Kob model	Pyrot 100	Pyrot 150	Pyrot 100	Pyrot 300
No. of boilers	1	1	1	1
Chip-fired Cost and savings				
boilers, shipped and installed	$202,537	$216,184	$202,537	$259,347
Slab/Building for Boilers	$5,000	$5,000	$5,000	$5,000
direct buried piping	$16,400	$16,400	$16,400	$227,500
interconnection	$20,000	$20,000	$20,000	$60,000
other	$15,000	$15,000	$15,000	$60,000
subtotal	$258,937	$272,584	$258,937	$611,847
soft costs	$82,213	$86,545	$82,213	$194,262
total	$341,150	$359,129	$341,150	$806,109
baseline oil cost	$64,976	$144,586	$57,558	$267,120
final oil cost	$22,872	$26,658	$24,032	$50,043
chip cost	$13,690	$38,343	$10,901	$70,580
total savings	$28,415	$79,585	$22,626	$146,497
Net Simple Payback				
stick-fired	6.0 yrs	4.5 yrs	6.8 yrs	5.5 yrs
chip-fired	12.0 yrs	4.5 yrs	15.1 yrs	5.5 yrs

Fort Yukon Feasibility

Summary of Results

Financial	Base P **A**	Base P **B**	Int P **A**	Int P **B**	Max P **A**	Max P **B**
estimated project cost :	$1,536,292	$1,856,504	$2,011,062	$2,331,274	$2,671,124	$3,033,012
estimated annual savings :	$227,748	$262,568	$263,777	$307,764	$380,381	$440,387
net simple payback, yrs :	6.75	7.07	7.62	7.57	7.02	6.89
Performance :						
:						
No. buildings connected :	6	6	8	8	9	9
peak load heating, kBTU/h :	2,295.0	2,295.0	2,645.6	2,645.6	3,450.3	3,450.3
peak losses to heating fuel, kBTU/h :	40.0	40.0	40.0	40.0	40.0	40.0
fraction :	0.017	0.017	0.015	0.015	0.012	0.012
:						
peak piping losses, KBTU/h :	72.1	72.1	115.9	115.9	198.4	198.4
fraction :	0.031	0.031	0.044	0.044	0.057	0.057
total losses, as a fraction of load :	0.049	0.049	0.059	0.059	0.069	0.069
:						
current oil consumption, gal/yr :	71,764	71,764	84,734	84,734	119,988	119,988
proposed consumption, gal/yr :	9,644	343	12,514	756	15,870	105
estimated savings, gal/yr :	62,120	71,421	72,219	83,978	104,118	119,883
fraction displaced :	0.866	0.995	0.852	0.991	0.868	0.999
:						
estimated wood chips, tons/yr :	1,134	1,303	1,318	1,533	1,900	2,188


KÖB
Heat from Wood


KÖB
PYROT®