Northwest Arctic Energy program

Co-Hosted & Sponsored by:

Northwest Arctic Borough – Energy Program

NANA Regional Corporation – Alternative & Village Energy Program

DOE program review
Noatak Solar-Battery IPP project
11/14/2022 Denver, Co

Nautaaq “Noatak” Ak

Noatak was established as a fishing and hunting camp in the 1800s. Two identifiable groups of Inupiat resided on the Noatak River.

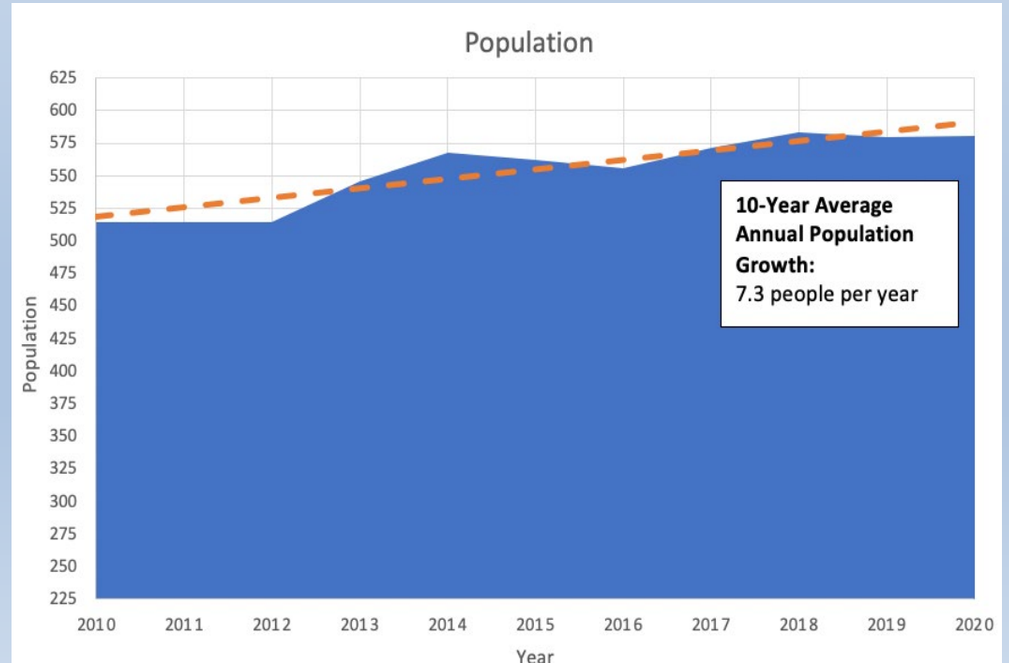
The *Nautaaġmiut* (called "Noatagamut" in the 1880 census), Inupiaq for "inland river people", lived upriver, and the *Napaaqtuġmiut*, meaning "people of the trees", lived downriver. By the early 20th century, the missionaries settled in what they called "Noatak". A United States post office was established in 1940.

Nautaaq “Noatak” Ak

DEMOGRAPHICS AND SOCIOECONOMICS

Year Incorporated Not Incorporated

Federally Recognized Tribe
Native Village of Noatak
Population (2020) 570
Median Age (2016-2020) 26.4
Percent Alaska Native / American Indian alone or in combination (2016-2020) 95%
Average Household Size (2016-2020) 4.28
Fuel Cost (2022)
$13.77/gallon (Gasoline)
$13.77/gallon (Heating Oil)
$ 0.91/Kwh electric rate pre PCE
Median Household Income (2016-2020) $55,000
Denali Commission Distressed Community (2018) Yes



The Noatak River

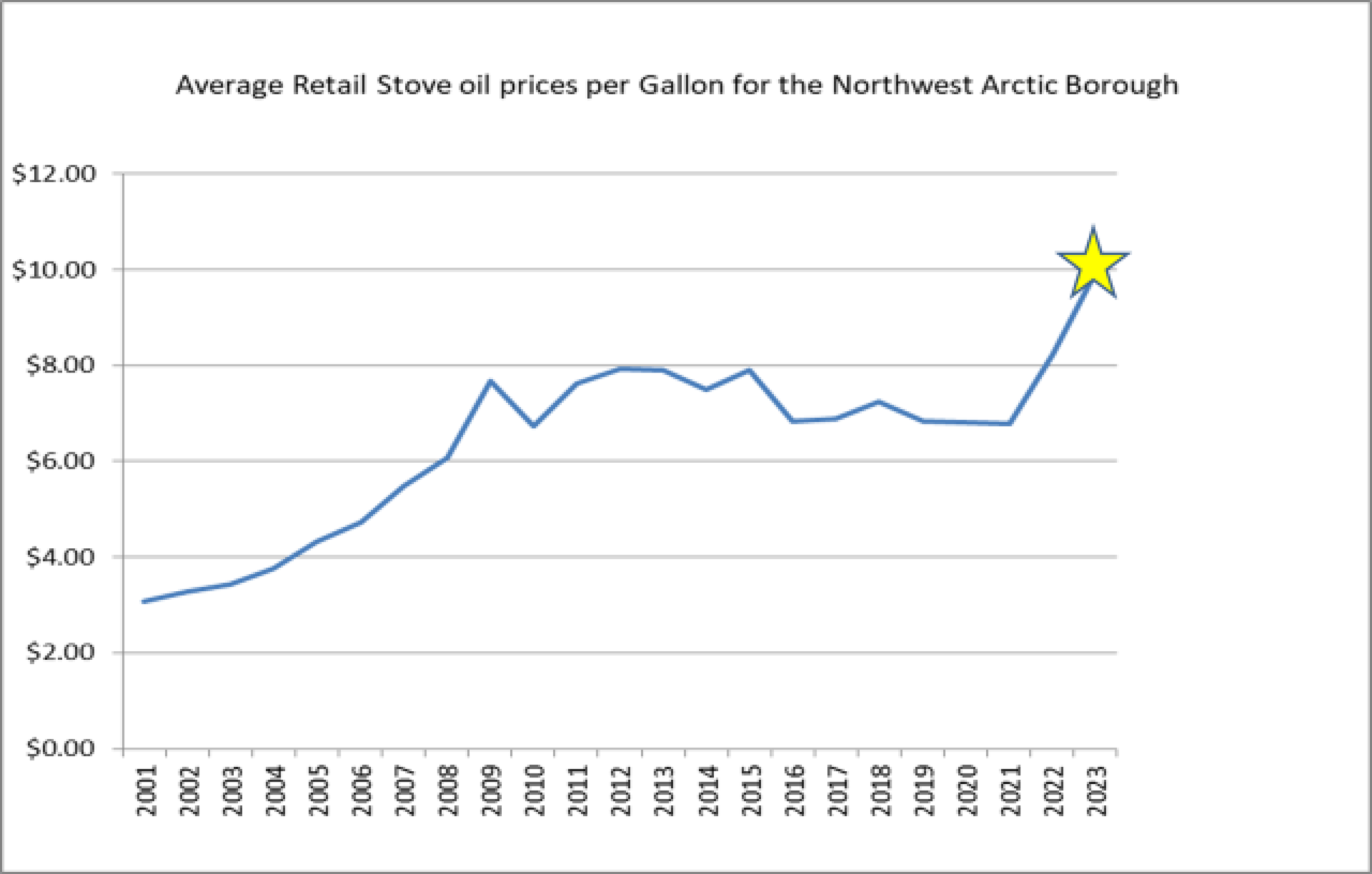
Over several decades the river channels have been shifting and Noatak can no longer be accessed by barge service.

The Community is slowly moving west as seen by the new subdivision and new School building.
A new runway is planned 3 miles west of the community.

Some background

Crude oil prices over time

source: tradingeconomics.com


Average Retail Stove oil prices per Gallon for the Northwest Arctic Borough
$12.00
$10.00
$8.00
$6.00
$4.00
$2.00
$0.00
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023

Fuel prices (tax included on retail) Aug. 2022

Community	Gasoline $/G Retail	Stove oil $/G Retail	Sales Tax included	Util. & AVEC Cost $ Barge/Air FY2022- FY2023	NWABS Cost $ FY2022- FY2023
Kotzebue KIC 6/23/22	8.99	9.12	6%	3.78	2.75-4.54
Kotzebue Vitus 8/18/22	7.99	7.57	6%		
Kotzebue Crowley 8/18/2022	7.80	7.97	6%		
Ambler	14.42	14.42	3%	4.49 /7.31/4.28	4.06-6.07
Kobuk 8/4/2022	13.91	15.45	3%	N/A	4.06-6.07
Shungnak	14.03	15.05	2%	5.45 / 9.46 /4.28	4.06-6.07
Kiana 8/4/2022	7.98	7.73	3%	2.82/4.18	2.68-4.71
Noorvik 8/4/2022	9.00	7.73	4%	2.96/4.63	2.68-4.71
Selawik	6.39	7.72	6.5%	2.854.52	2.68-4.71
Buckland 8/3/2022	7.65	7.66	6%	2.13-3.547	2.89-5.25
Deering 7/7/2022	5.50	5.20	3%	2.13-4.057	2.68-4.71
Kivalina 8/8/22	6.52	6.52	2%	2.78/4.18	2.68-5.16
Noatak 6/23/22	13.77	13.77	6%	8.10/9.19	7.24

NAB Electric rates July 2022

Community	1-500 $/Kwh	Tax	1-500 Kwh Actual cost/Kwh with tax	501-700 $/Kwh No tax	700-up $/Kwh No tax	Utility Non firm power purchase rate $/Kwh 7/1/2022
Kotzebue	0.2057	6%	0.2180	0.3412	0.3412	N/A
Ambler	0.2473	3%	0.2547	0.8198	0.7198	0.3714
Kobuk	0.2505		0.2505	0.6776	0.7842	N/A
Shungnak	0.2505	2%	0.2555	0.6776	0.7842	0.5122
Kiana	0.2318		0.2318	0.5083	0.4083	0.1557
Noorvik	0.2329	4%	0.2422	0.5309	0.4309	0.1685
Selawik	0.2316	7%	0.2478	0.5058	0.4058	0.1433
Buckland	0.2823		0.2823	0.4900	0.4900	0.2823
Deering	0.481		0.481	0.6747	0.6747	0.3575
Kivalina	0.2317	2%	0.2363	0.5063	0.4063	0.1552
Noatak	0.2518	6%	0.2669	0.9093	0.8093	0.4868

Noatak Solar IPP

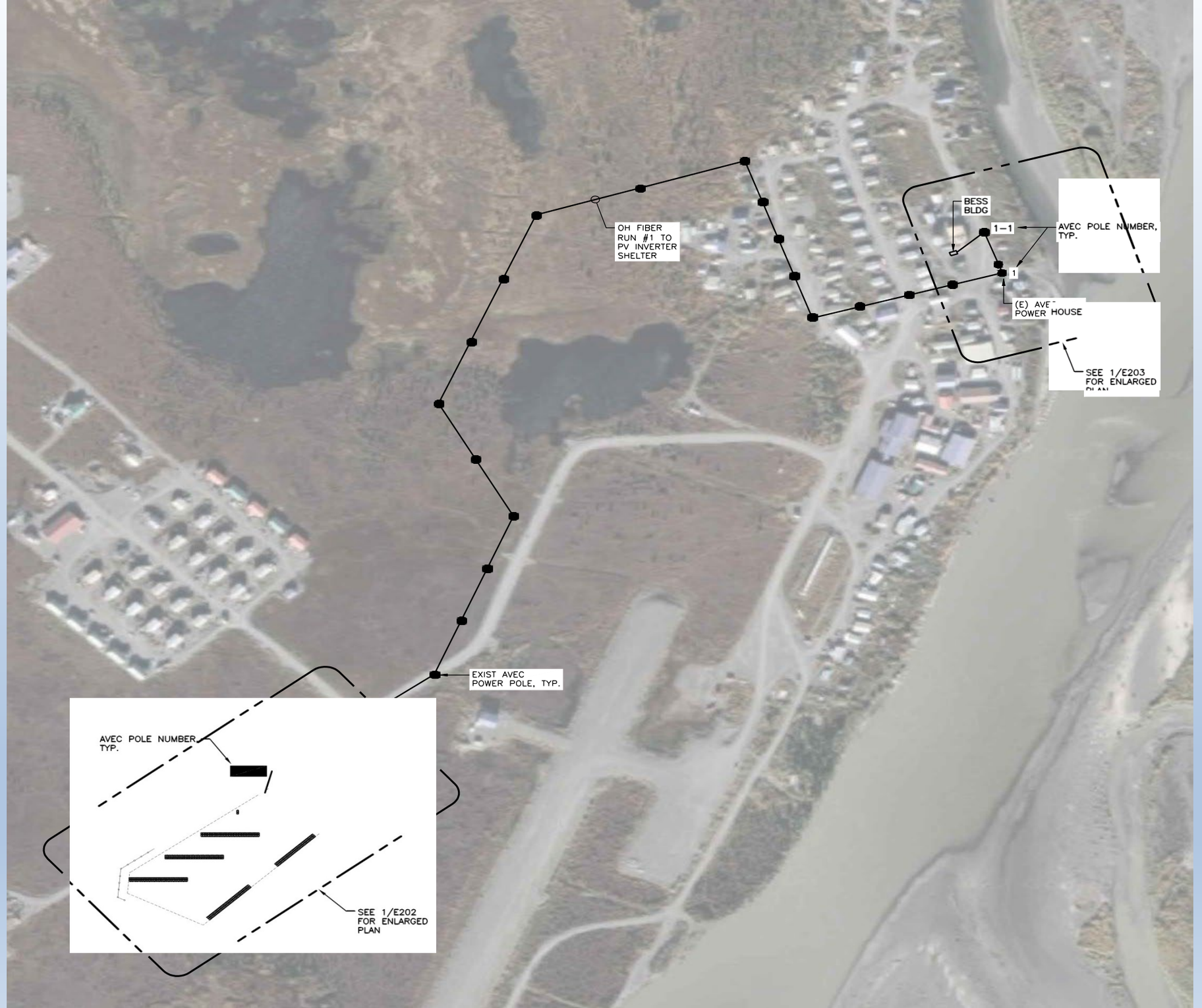
Solar PV Array and Battery – *Expected 2023*

- Install 280 kW solar PV and inverters
- Install 500 kW/460 kWh battery storage system
- Upgrade switchgear, *Completed 2021*
- Estimated annual savings:
  $178,000 & 18,840 gallons of diesel

Total Estimated cost ; $ 2,946,886.00

- Awards:
  - $2,008,765 award 2021 by DOE OIE
  - $310,000 award 2021 by Village Improvement Fund
  - $134,079 award 2022 from Denali Commission
  - $250,000 award from NANA VEI
- $100,000 award in 2022 from Teck Cominco
- $84,044 Northwest Artic Borough


Legend
Path Measure
Main St
Noatak Rd
30x20
fenced in
battery
building with
1- 4' gate
AVEC plant
Google Earth
Image © 2022 CNES / Airbus
N
200 ft


OH FIBER RUN #1 TO PV INVERTER SHELTER
BESS BLDG
1–1
AVEC POLE NUMBER, TYP.
1
(E) AVEC POWER HOUSE
SEE 1/E203 FOR ENLARGED PLAN
EXIST AVEC POWER POLE, TYP.
AVEC POLE NUMBER, TYP.
SEE 1/E202 FOR ENLARGED PLAN

Noatak Solar-Battery IPP project
Phase 1 2022-23

- **Noatak 280.6 DC/250Kw AC Kw Solar/battery PV**

- **Using 432 pc Canadian solar Bifacial 650 W panels**
- **Kronus/Pylontech environmentally friendly LFP Battery @ 442Kwh capable of holding the community for 2 Hours without Generators or Solar power.**
- **Capacity 492Kw/352Kwh with room for expansion.**
- **Inverter is an EPC 500Kw**

- **Start of construction Sep 2022 and to be completed June 2023.**

- **Site clearing and 95% engineering completed as of end of October 2022.**
- **Equipment will be secured during the winter for mobilization to Noatak March-April 2023.**
- **Construction and commissioning April-June 30th 2023.**

Noatak 280.6-380.6 Kw expansion
Phase 2 in 2024-25

- Initial Solar array size 280.6 Kw with expansion to 380.6 Kw
- Kronus Pylontech battery system – 123 kw/rack – 492 kwh 90% usable – 442 kwh
- with expansion to 738 kwh 90% = 664kwh
- Inverter is an EPC 500Kw

- This project is expected to displace 21,428 Gallons of diesel annually in phase 1.
- and 28,700 Gallons annually after phase 2 build out.
- 692,800 gallons over the 25-year life of the project.

Energy Projects that has been completed

LED Streetlight Retrofit Borough-Wide – Completed 2015

- Installed 22 LED streetlights in Noatak
- 25-year all community savings: ~$2.4M & ~925,000 gal diesel
- State of Alaska, Grants to Municipalities

o Funding awarded 2014

o $200,000 awarded to Northwest Arctic Borough

Water Plant Solar PV – Completed 2013

- 7.5 kW solar PV installed
- Average 19.1 kWh/day; still operational
- Coastal Impact Assistance Program (CIAP)

o $87,925 awarded

O Savings abut $ 3,000.00/year

Future Energy Projects –

Community-Wide Residential LED Lighting Upgrade

- Upgrade all residential lighting fixtures to energy efficient LED lighting
  - Survey type and quantity of lighting fixtures in all homes
  - Apply for Village Improvement Fund support
  - Procure and install energy efficient lighting
- Reduce residential electricity costs

Water Treatment Plant Upgrade

- Water treatment plant (WTP) will be reinforced or relocated due to unstable ground
  - Changes in permafrost and erosion threaten stability of WTP
  - The well is not producing enough water
  - Opportunity to prioritize energy efficiency upgrades in facility upgrade
- Energy efficient construction
- Optimize recovered heat system

New Fuel Line / Power Plant Relocation

- Construct a new fuel line from the new airport to the AVEC bulk fuel tanks
  - Flown-in fuel necessitates new fuel line from new airport
- Power plant relocation
  - Currently built on land that is eroding into the Noatak River and at risk of flooding
  - AVEC interested in relocating power plant and new bulk fuel tank siting

Community Goals –

- Reduce cost of residential space and water heating
  - Implement energy efficiency measures and upgrades
  - Maintain and/or replace aging residential heating appliances
- Enhance resiliency of residential heating by diversifying heating appliances and fuel types

- Develop long-term strategies to mitigate the high costs and delivery frequency of flown-in fuel
  - Construct new fuel line
  - Develop additional sources of renewable energy
  - Reduce fuel consumption through energy efficiency upgrades

- Develop renewable energy microgrid, Solar PV and battery storage
  - Develop Independent Power Producer agreement to sell power to

Improve energy efficiency of water and sewer systems

- Enhance funding to support local AVEC operator
  - Expand responsibilities to include operation and maintenance of solar PV and battery systems
    - Create additional training opportunities for operators to enhance skills and understanding of microgrid

- Partner with Northwest Inupiat Housing Authority to implement policy changes to prioritize and invest in energy efficiency in newly constructed home

Thank you from The Tribal Council of Noatak, to all Noatak Solar/Battery IPP Partners

NANA

teckcominco

ALASKA NATIVE RENEWABLE INDUSTRIES

ageto

Deerstone Consulting

AVEC
ALASKA VILLAGE ELECTRIC COOPERATIVE

DAYLIGHT ENERGY SERVICES

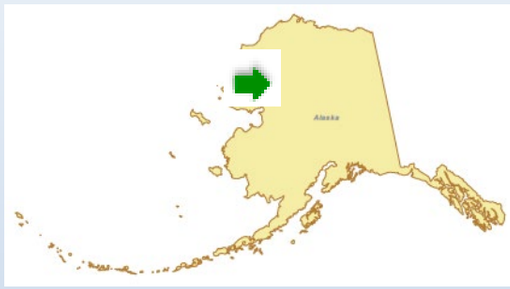
The Road to the development of

Northwest Arctic Independent power producers (NWAIPP)

Buckland Solar arrays, Courtesy NANA

SUSTAINABLE ALTERNATE ENERGY DEVELOPMENT IN NWAB

2012-2013 NAB Synergy project



- Borough population: 7,810
- Electricity for village water / sewer plants
- Launched in Ambler, replicating across borough
- 10,000 kWh/year from 10 kW array
- Peak production April-July
- Long sunlight hours in summer + 30% reflection from snow-covered ground in spring

Photos: Northwest Arctic Borough

Powering water treatment facilities with renewable energy

Deering WP

After a year we knew what we had 10 Mwh from a 10 Kw array

Status

4

MEDIUM

Power Right Now

-- kW

Energy Generation

TODAY	LIFETIME
0.0 kWh	10.0 MWh

Yahoo! Weather
near Deering, AK United States

26 °F
Cloudy

Atmosphere
Humidity: 85%
Pressure: 2.43 '
Visibility: 6.00 mi

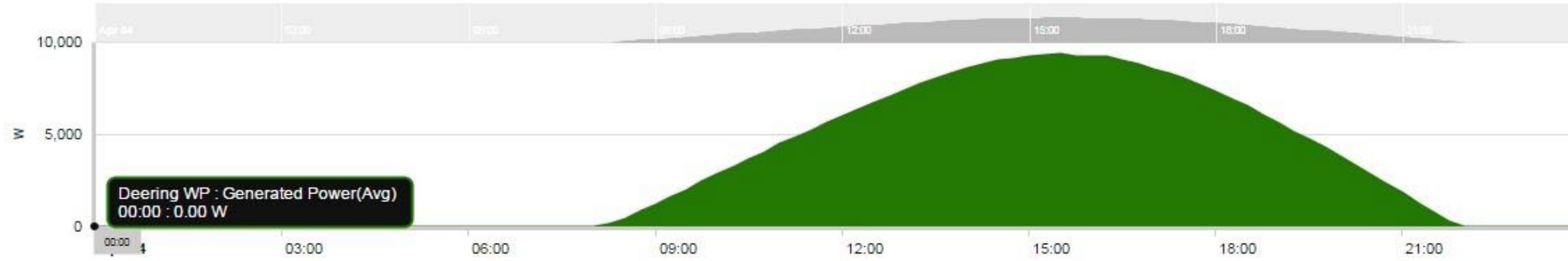
Wind
Speed: 22.00 MPH
Direction: 50

Deering WP array

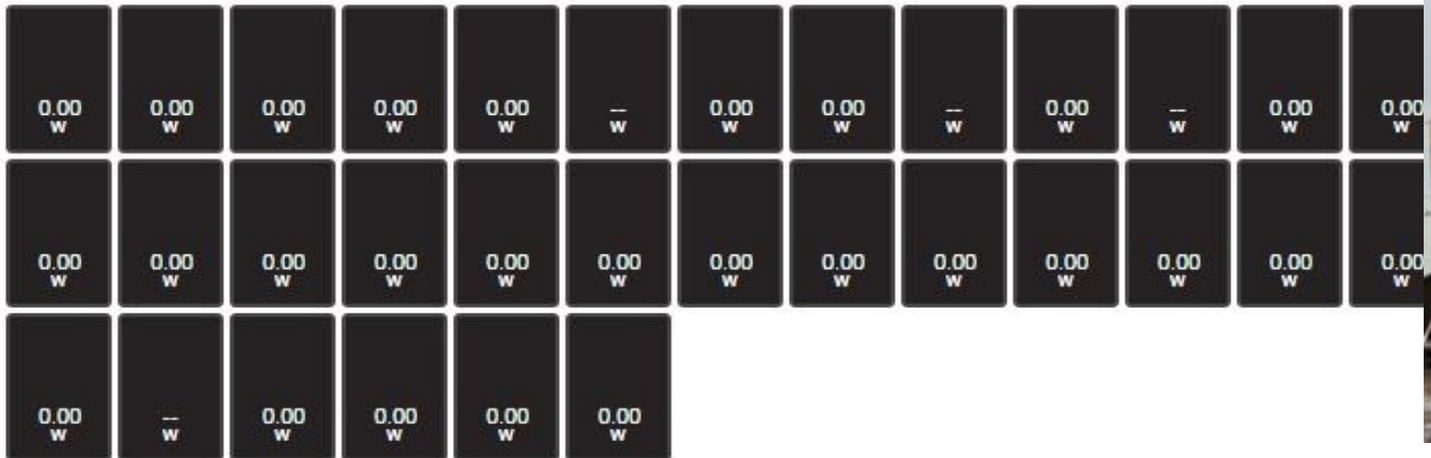
Power

1D 7D 30D 12M WTD MTD YTD

Apr 04, 2015 - Apr 04, 2015



Modules



Approximate minimum value per year of behind the meter Solar projects at NAB Water plants due to PCE. Based on actual value for consumer.

	Installed Kw	Production Kwh	Value/Kwh	Value Per year
Ambler	8.4	8400	0.2547	$2,139.48
Kobuk	7.38	7380	0.2505	$1,848.69
Shungnak	7.5	7500	0.2555	$1,916.25
Noorvik	12	12000	0.2422	$2,906.40
Noatak	11.27	11270	0.2669	$3,007.96
Deering	11.13	11130	0.3575	$3,978.98
Kotzebue-1	10.53	10530	0.2180	$2,295.54
Kotzebue-2	10.53	10530	0.2180	$2,295.54
Selawik	9.72	9720	0.2478	$2,408.62
Kivalina	10.53	10530	0.2363	$2,488.24
Kiana	10.53	10530	0.2318	$2,440.85
Buckland	10.53	10530	0.2823	$2,972.62
Total	120.05	120,050		$30,699.17

Total Estimated savings per year

$ 30,699.17

However the production is invisible to the utility, and no PCE is collected for it from AEA.

Possible available funding for Solar projects under IPP management per year

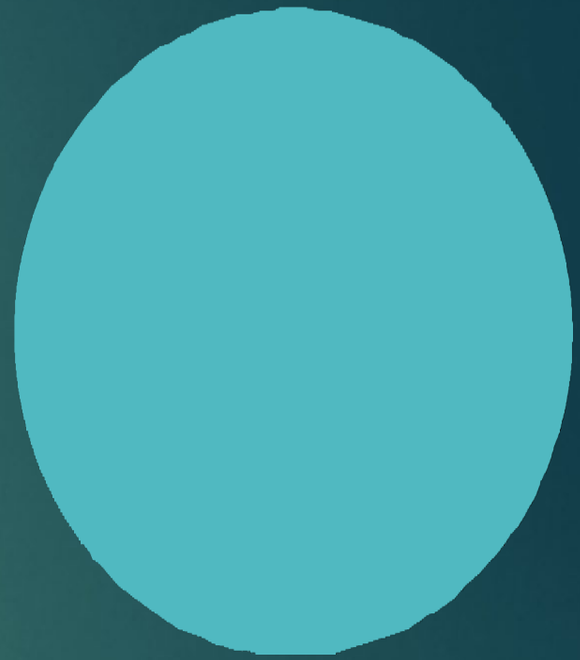
Community	Installed Kw	Production Kwh	Behind meter PCE value / Kwh	Avoided Diesel rate $/Kwh	Value under IPP Management $/Kwh
Shungnak Ut	233	200,000	$51,100.00	0.5059	$ 108,180.00
Noatak Ut	275	250,000	$66,725.00	0.5518	$ 137,950.00
Noorvik Ut	23.4	23,400	$5,667.48	0.2510	$ 5,873.40
Deering Ut	48.5	48,500	$17,338.75	0.3500	$ 17,338.75
Buckland Ut	45.99	45,000	$12,703.50	0.2823	$ 12,703.50
Total	625.89	566,900	$ 153,534.73		$ 282,045.65

So why develop Independent power producers

- The Communities taking control of their Energy future, creates buy in and good relationships with the utility.
- Being able to sustain PCE support to the communities and stabilize energy cost.
- Better economics
- funding collected pays for further development and local workforce expertise in renewable Energy production.

Reasons for Regional approach to Alternate Energy Development

- *Regional* support to apply for and manage Energy grants, including access to Dept. of Energy and other funding.



- Economy of Scale and Increasing Efficiency
- Develop Regional Energy infrastructure:
- Wind, Solar, Hydro, Interties, bulk fuel storage & direct Household involvement.
- Admin help for Independent power producers (IPP's) for PCE calculations, utility rates & billing.
- Job Creation - Workforce Development and Training/Capacity building.
- The Region speaking with one voice. Can advocate on behalf of PCE.
- This is needed to lower the increasing cost of living and hedge against fuel increases and supply disruptions.

Key Conclusions

- Without the Regional approach we cannot successfully implement Independent Power Production (IPP's)

- So far we would miss out on approximately $ 282,045.65/year that could be collected implementing IPP's under a joint operation like the Northwest Arctic Independent Power producers.

- Additionally the approach allows for small Fuel Coops to exist under the umbrella structure.
- NAB involvement provide the assurance that financial benefits will be distributed appropriately.

The Shungnak Kobuk Solar IPP Project

Shungnak-Kobuk 223.5 Kw Solar/battery PV array.
Using 550pc Bifacial 405W panels

Blue Planet environmentally friendly LFP Battery.
Capable of holding the to communities for 2 Hours without Generators or Solar power.
Capacity 250Kw/352Kwh

Start of construction April 2021 completed Sep 2021.

Total project cost $ 2,363,215.11

Funded by USDA HECG @ $ 1,291,675.00
In-kind VIF and NAB funds $ 1,071,540.11

“Energy is our most precious resource, for it is the means by which we transform our creative potential into meaningful action.” Tarthang Tulku

Construction 2021

Local crew from the Shungnak Project

Courtesy Alaska Native Renewable Industries (ANRI)

One week in March

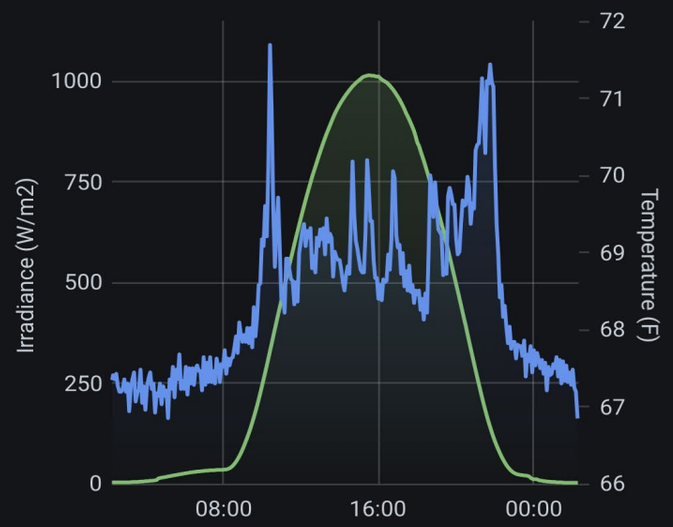
6:17 LTE

10027 Shungnak 2

20s

	min	max	avg	current
PV1	0	96.9	34.5	0
PV2	0	95.2	34.6	0

Irradiance and Temperature



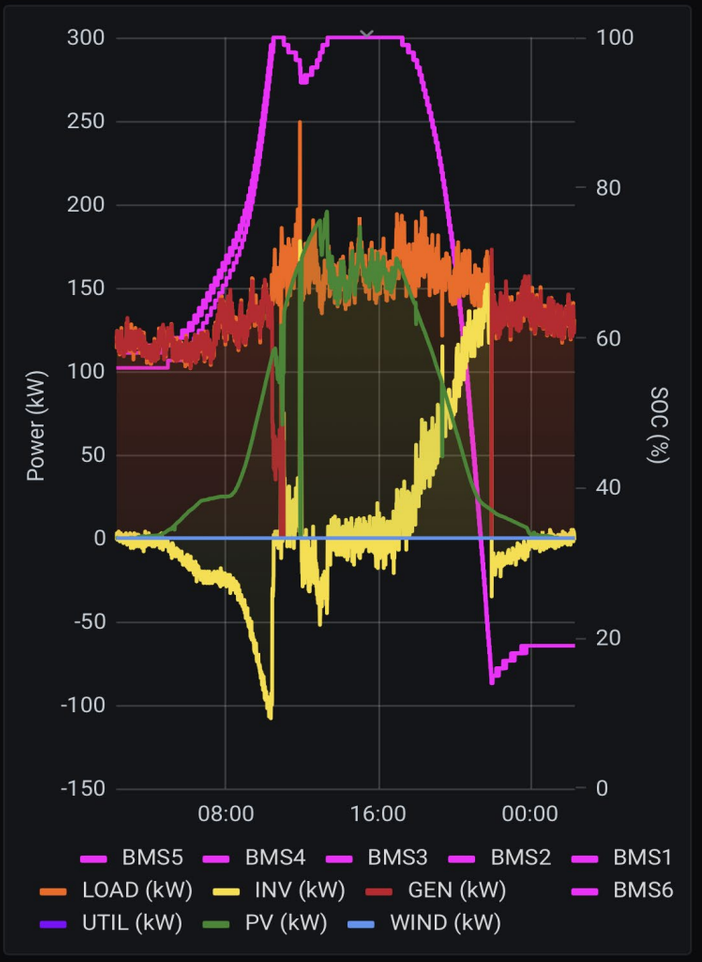
	min	max	av
Irradiance (W/m2)	2.0	1015.1	36
Battery building temp (F) (right-y)	66.8	71.7	6

AA initium.agetoenergy.com

6:17 LTE

10027 Shungnak 2

20s



INV # BMS # PV # GEN #

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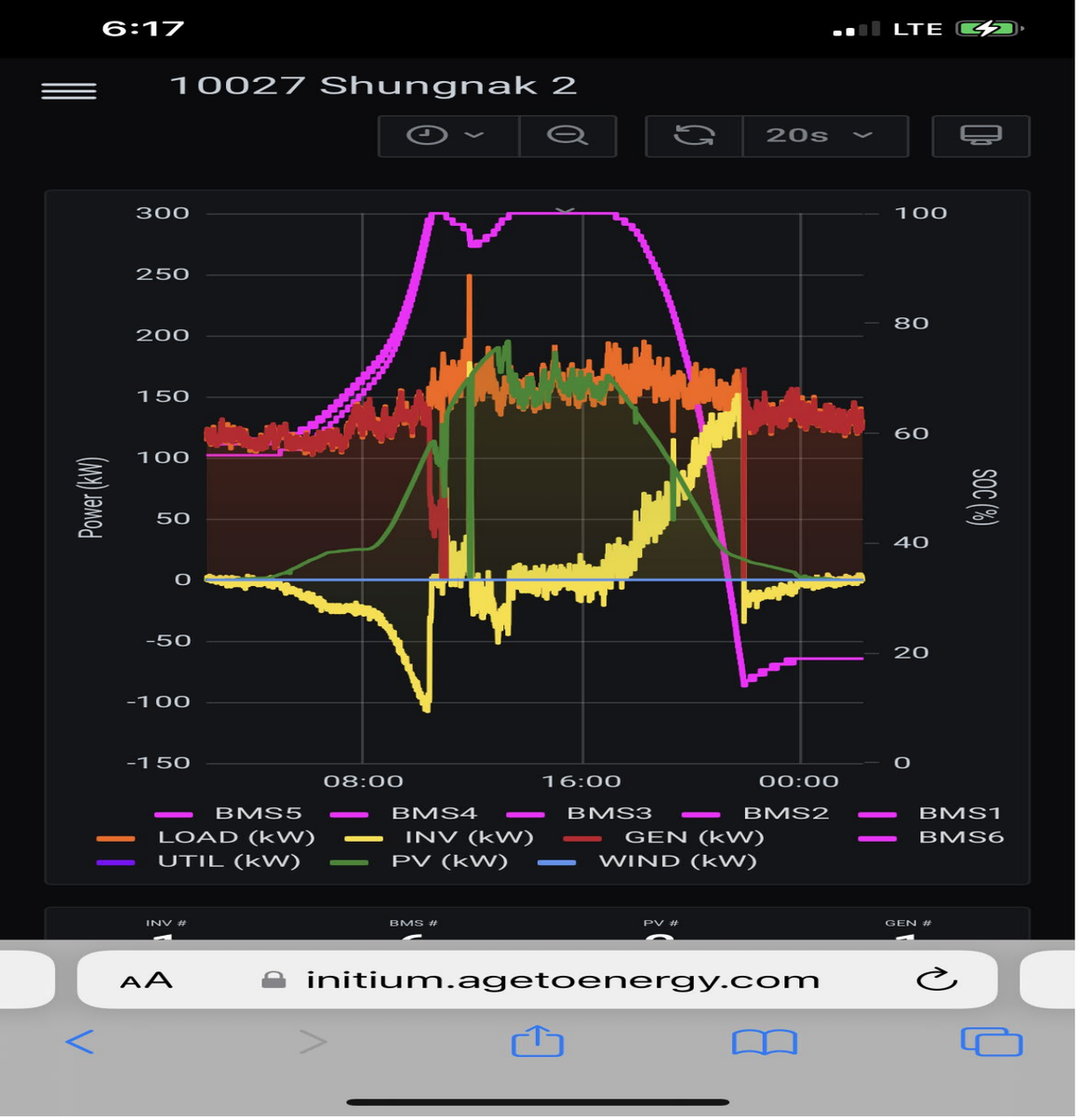
10027 Shungnak 2

20s



Shungnak
Monthly Energy Report
Jun 01, 2022 - Jun 30, 2022

June 2022

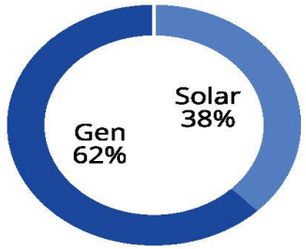
ageto

Your microgrid this month

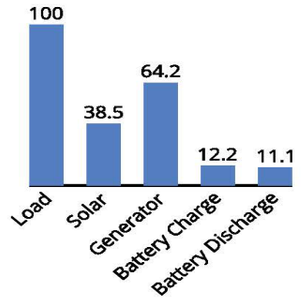
Produced	Offset	Avoided
38.5 MWh of solar	29.7 tons of CO_2	2,851 gal of fuel

That's like planting 31 trees!

Energy produced



Energy totals (MWh)



You went renewables only!

This month your system operated

213 hours

generators off

Weather

No data for location

Renewables accounted for 38% of your energy consumption this month resulting in $14,950 in fuel savings

All values and amounts listed in this report are generated based on estimated constants, variables, and assumptions. The avoided fuel value is based on diesel equivalent. While this report is meant to closely and accurately represent the actual amounts saved or earned, Ageto assumes no responsibility or liability for any errors, omissions, or misrepresentations of data used to generate this report.

- **As of end of Sep. 2022, since commissioning in Sep. 2021.**
- **215 Mwh of electricity have been generated**
- **Equal to about 15,360 Gallons not needed & 166 Tons of CO2 offset**
- **Together with a total of 778 Hours of Diesel/off operation. Equal to just over a Month of clean energy**

Shungnak Yearly financials FY22

Estimated Gross Annual Revenue	$120,000.00
Insurance	$3,771.32
Electric	$1,958.05
Ageto service fee	$3,242.28
Tribe Employee	$8,683.44
Fuel	$3,150.00
Total Estimated Expenses	$20,805.09
Estimated Net Income	$99,194.91
Estimated Administrative Fee (10% Annual Net)	$9,919.49
Annual Income Less Admin Fee	$89,275.51

Questions in the works for Shungnak-Kobuk IPP.

- How do we capture the heat from the Battery
- and the Inverters ?

&

- In relation to the communities load
- what is the optimum configuration of;
- Solar PV size
- Battery capacity
- Max Diesel off time
- Cost of equipment

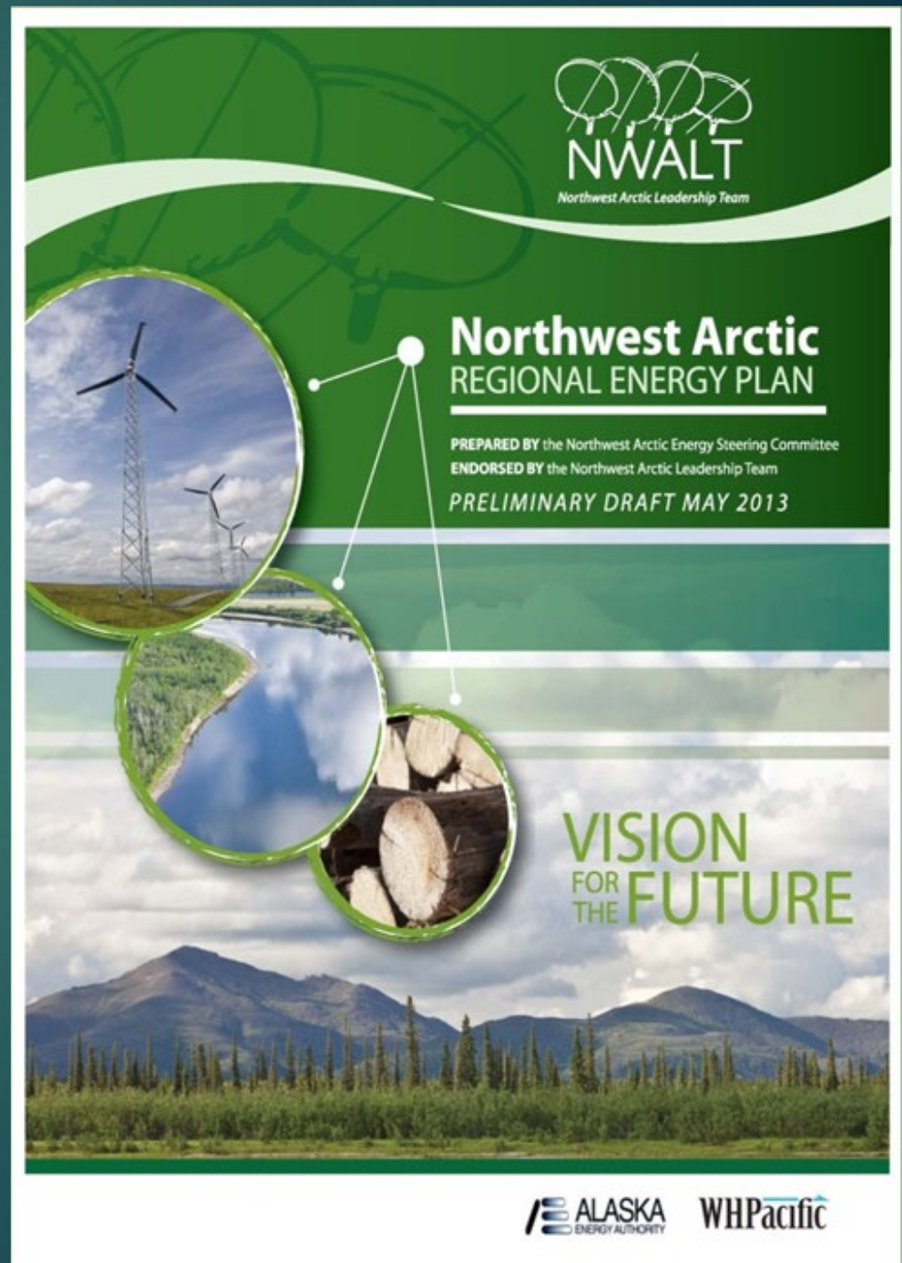
- And what is Diesel off worth / Hour ?
- Next steps

- Possibly add a wind turbine to the project.

The Energy Plan & Management

Built on the success of the Regional Energy Steering Committee, the IPP's will be overseen by an executive board of Directors, one each from the regions Communities and Stakeholder entities that will meet twice a year to ratify the Regional Energy plan.

The vision is for the Northwest Arctic region to be 50 percent reliant on regionally available energy sources, both renewable and non-renewable, for heating and generation purposes by the year 2050.
And to combat rapid climate change due to greenhouse gas emissions like Co2, Methane and other harmful effects of fossil fuel usage.



Going forward

- **Continue with build out of Solar/Battery IPP's for all communities, approximate average cost per community needed is $ 2.8 Mil**

- **Continue working with communities that have wind resources to possibly fund Wind turbines in Shungnak, Noorvik, Selawik and Kivalina.**

- **Continue working on a solution for an**
- **Electrical Intertie between Ambler and Shungnak**

- **Together with all Stakeholders in the upper Kobuk investigate the possibility of developing the Kogoluktuk hydro potential for electric power for Kobuk, Shungnak and Ambler.**

- **Continue to evaluate the use of Heat-pumps for energy efficiency in space and water heating applications.**

A Dream you dream alone is only a dream.
A dream you dream together is reality. Yoko Ono

Kogoluktuk River falls a possible Hydro project for future development

Ingemar Mathiasson NAB
Energy Manager
Imathiasson@nwabor.org

Bill Stamm
AVEC CEO
bstamm@avec.org

Credits to :
NANA ; Sonny Adams
Deerstone Consulting; Brian Hirsch
ANRI ; Edwin Bifelt

Thank You DOE