Alaska Rural Energy: Challenges & Opportunities for Reducing Costs

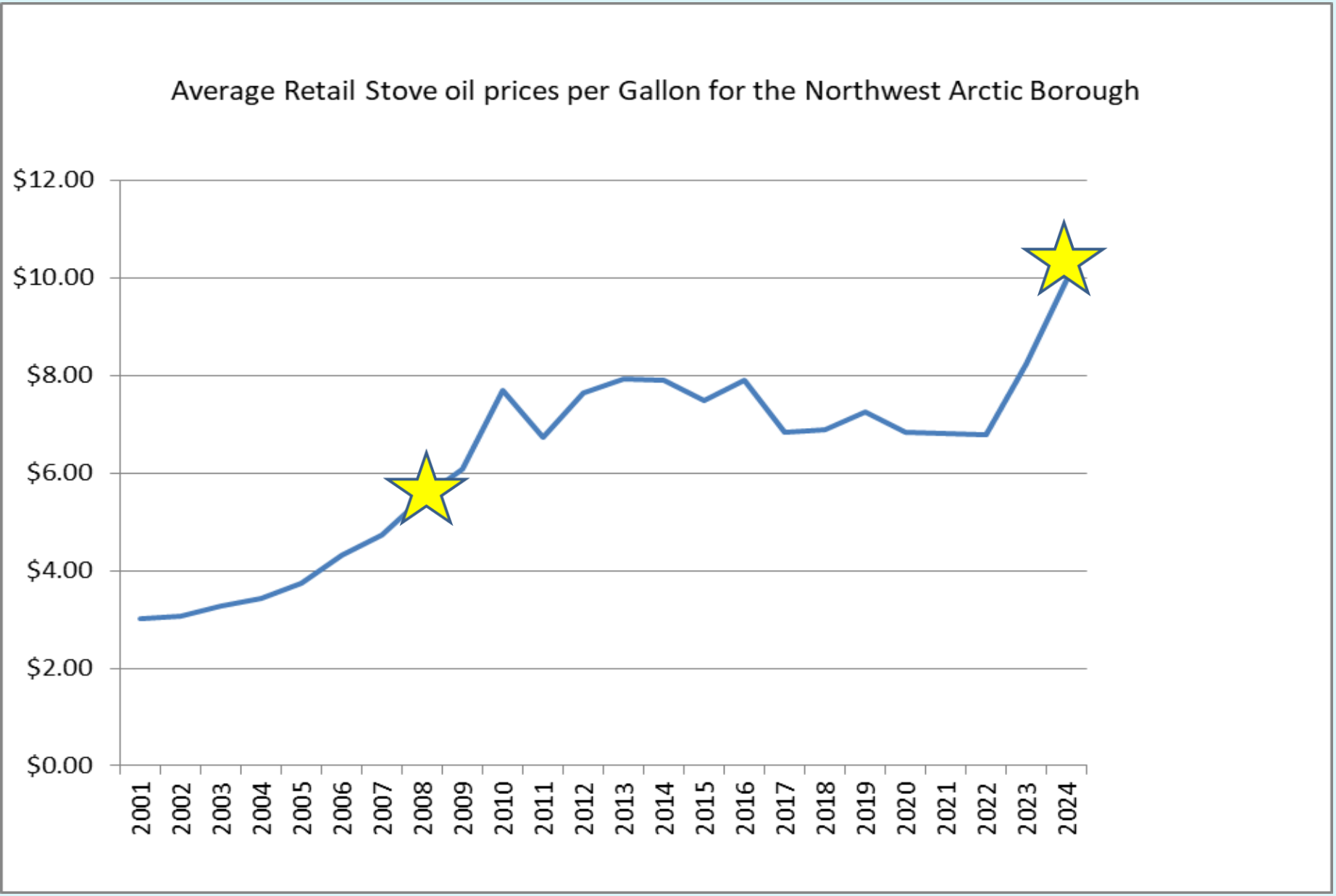
Public Private Partnerships & The case for Community – IPP's

Why are we here ?

Challenges

2008 Energy Summit

Brent Crude oil prices over time


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
2024

Fuel prices (tax included on retail) April. 2023 & FY24

Community	Gasoline $/G Retail	Stove oil $/G Retail	Sales Tax included	Util. & AVEC Cost $ Barge/Air FY2022- FY2023	NWABS Cost $ FY2023- FY2024
Kotzebue KIC and KEA	8.99	9.12	6%	3.71 KEA/ 3.20	4.54/4.7605
Kotzebue Vitus	7.99	7.57	6%		
Kotzebue Crowley	7.80	7.97	6%		
Ambler	14.42	14.42	3%	4.49 /11.50	6.07/6.2505
Kobuk	13.91	15.45	3%	N/A	6.07/6.2505
Shungnak	14.03	15.05	2%	5.45 / 11.50	6.07/6.2505
Kiana	7.98	7.73	3%	2.82/4.18	4.71/5.0005
Noorvik	7.21	6.18	4%	2.96/4.63	4.71/5.0005
Selawik	5.68	6.58	6.5%	2.854.52	4.71/5.0005
Buckland	7.65	7.66	6%	2.13-3.547	5.25/5.0005
Deering	5.50	5.20	3%	2.13-4.057	4.71/5.0005
Kivalina	6.52	6.52	2%	2.78/4.18	5.16/5.0005
Noatak	14.49	15.31	6%	8.10/10.75	7.24/10.96

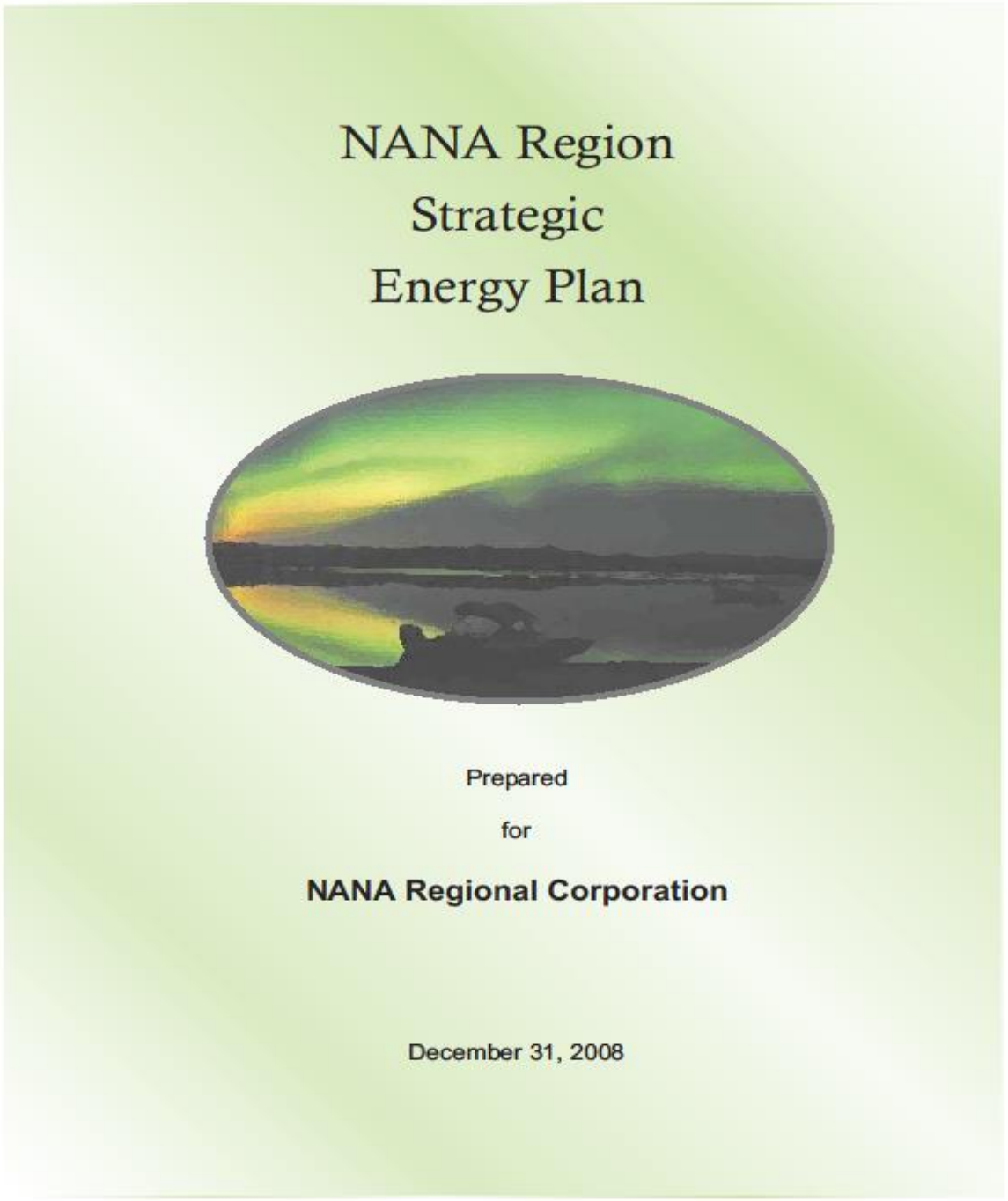
NAB Electric rates, Apr 6 2023

Community	1-750Kwh $/Kwh with PCE	Tax	1-750 Kwh Actual cost/Kwh with tax	0-750 $/Kwh No tax	750-up $/Kwh No tax	Utility Non firm power purchase rate $/Kwh 1/30/2023
Kotzebue KEA	0.2275	6%	0.24	0.3949	0.3918	N/A
Ambler AVEC	0.2651	3%	0.2731	0.8621	0.7566	0.3949
Kobuk AVEC	0.3348		0.3348	1.0988	0.9933	N/A
Shungnak AVEC	0.3348	2%	0.3414	1.0988	0.9933	0.6138
Kiana AVEC	0.2553		0.2647	0.6654	0.5599	0.2733
Noorvik AVEC	0.2545	4%	0.2647	0.6490	0.5435	0.2507
Selawik AVEC	0.2521	7%	0.2697	0.6027	0.4972	0.2053
Buckland BEC	0.2781		0.2781	0.4900	0.4900	0.2823
Deering IEC	0.4081		0.4081	0.6747	0.6747	0.3575
Kivalina AVEC	0.2535	2%	0.2586	0.6295	0.5240	0.2442
Noatak AVEC	0.3724	6%	0.3947	1.1364	1.0309	0.6682

2008

NANA Regional
11 communities

Kotzebue
Noorvik
Selawik
Kiana
Deering
Buckland
Noatak
Kivalina
Ambler
Shungnak
Kobuk



Northwest Arctic Energy Steering Committee

Co-Hosted & Sponsored by:

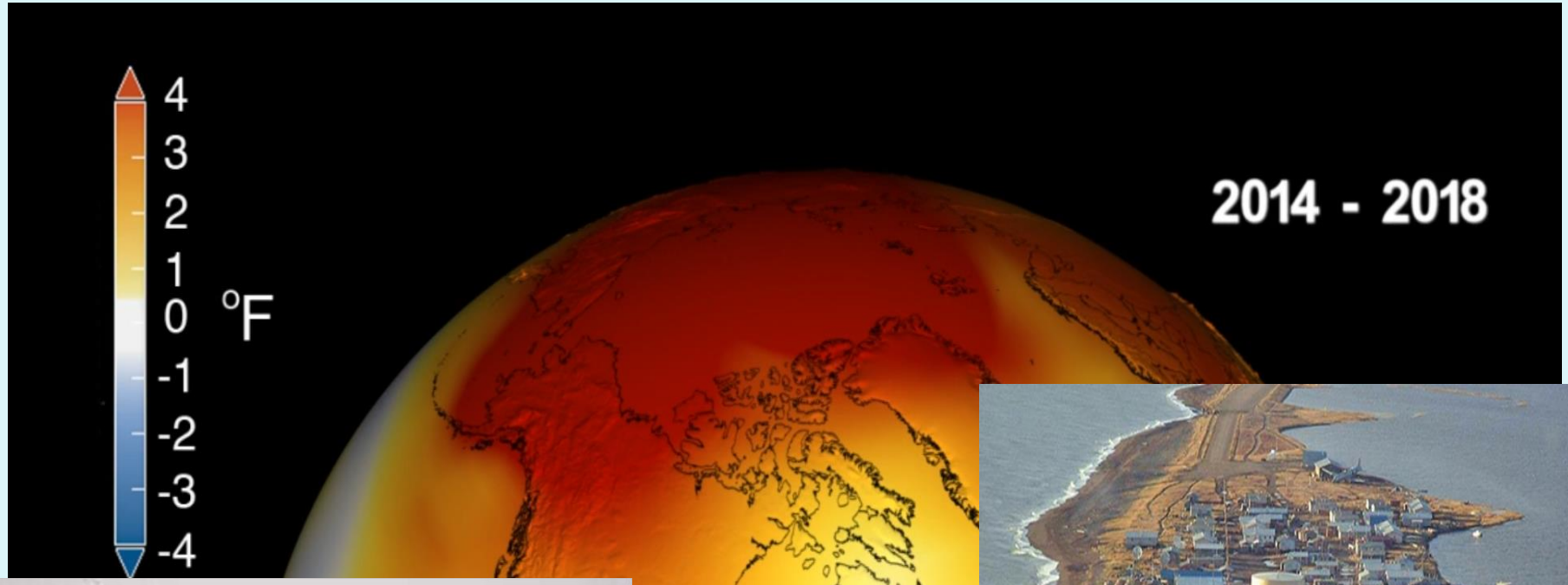
Northwest Arctic Borough – Energy Program

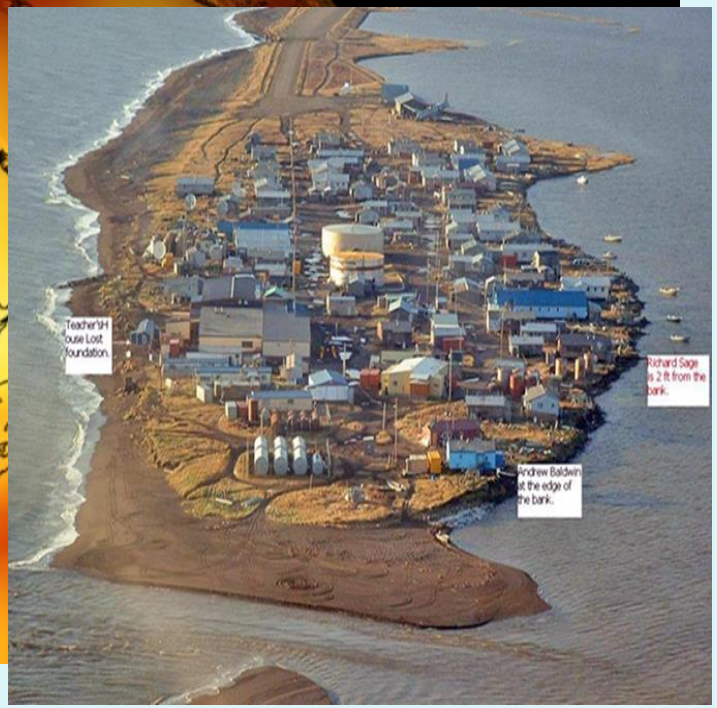
NANA Regional Corporation – Alternative & Village Energy Program

2009-2023

The Artic Warming up faster than the rest of the world

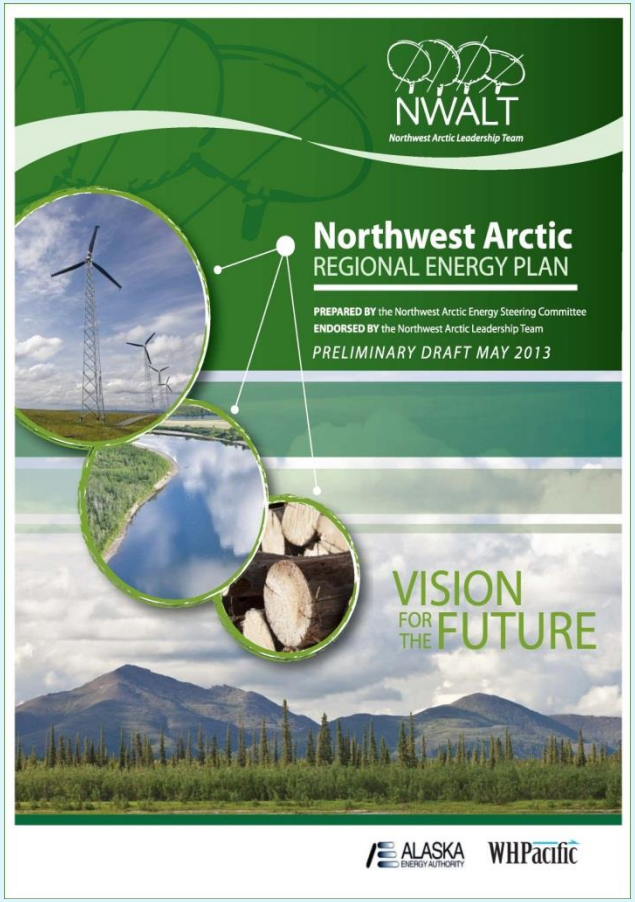
Climate Change Mitigation Plans was needed





NANA-NAB Energy planning
Started in 2008-2009
Current version 2020
Available @Nwabor.org

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.



The progression is planned as follows:

10 percent decrease of imported diesel fuels by 2020
On track
25 percent decrease of imported diesel fuels by 2030
50 percent decrease of imported diesel fuels by 2050

To get there, we need to go;

Diesels Off

Our Single Focus in 2008-2012

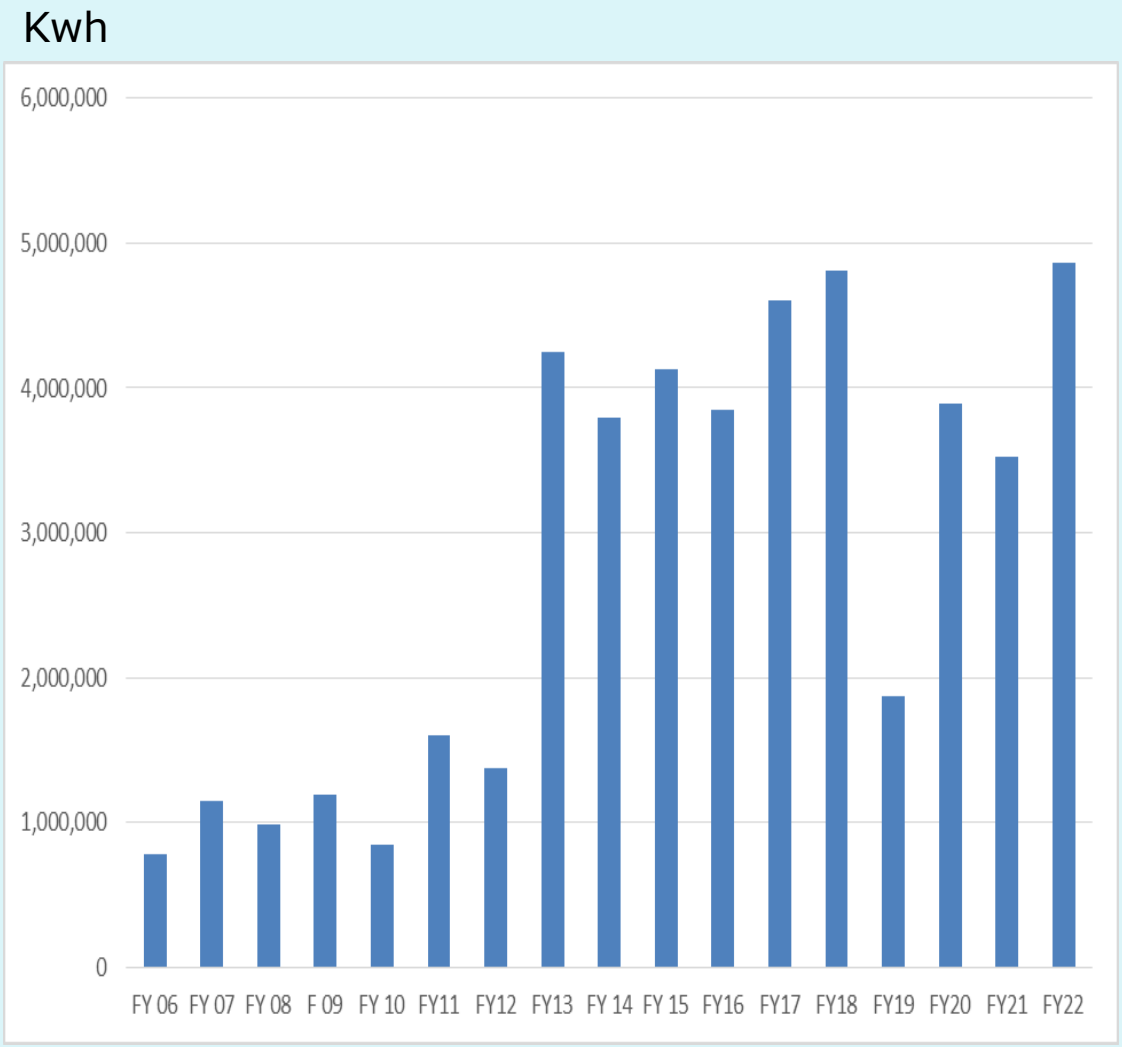
- **To try to stabilize the cost of electricity by developing local energy resources as much as possible (Wind-Hydro) and possibly bring down cost/Kwh**

- **Projects were funded and then implemented by Electric Utilities to offset the use of Diesel fuel.**

- **However, the cost to the Households $/Kwh, did not change in communities that receives PCE funding,**
- **Instead, as more Alternate Energy projects were built by grants, the allocation of PCE decreased to the communities.**

2007-2012 Wind diesel projects

Wind projects and data



	Total Kwh	Diesel Gallon saved	Value $ 3.75/Gallon
Selawik	1,158,985	82,785	$310,442.41
Buckland	1,105,121	78,937	$296,014.55
Deering	559,725	39,980	$149,926.34
Kotzebue	44,662,843	3,190,203	$11,963,261.52
Total	47,486,674	3,391,905	$12,719,644.82

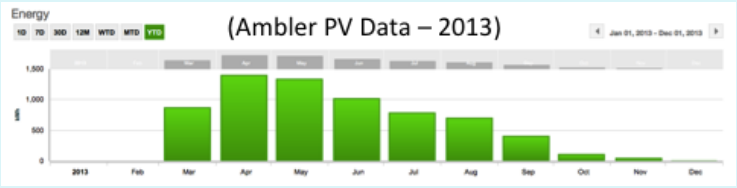
3.4 Mil Gallons of Diesel not needed

Independent Power producers shows up in Alaska
Fire Island

- September **2012**
- The project started production in September 2012 and supplies approximately 2% of Chugach's retail load under a 25-year power purchase agreement with Cook Inlet Region Incorporated and its subsidiary Fire Island Wind LLC, who owns and operates the facility.

2012 NAB Synergy project over 10 Years has saved 50,000 Gallons

- 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



Powering water treatment facilities with renewable energy

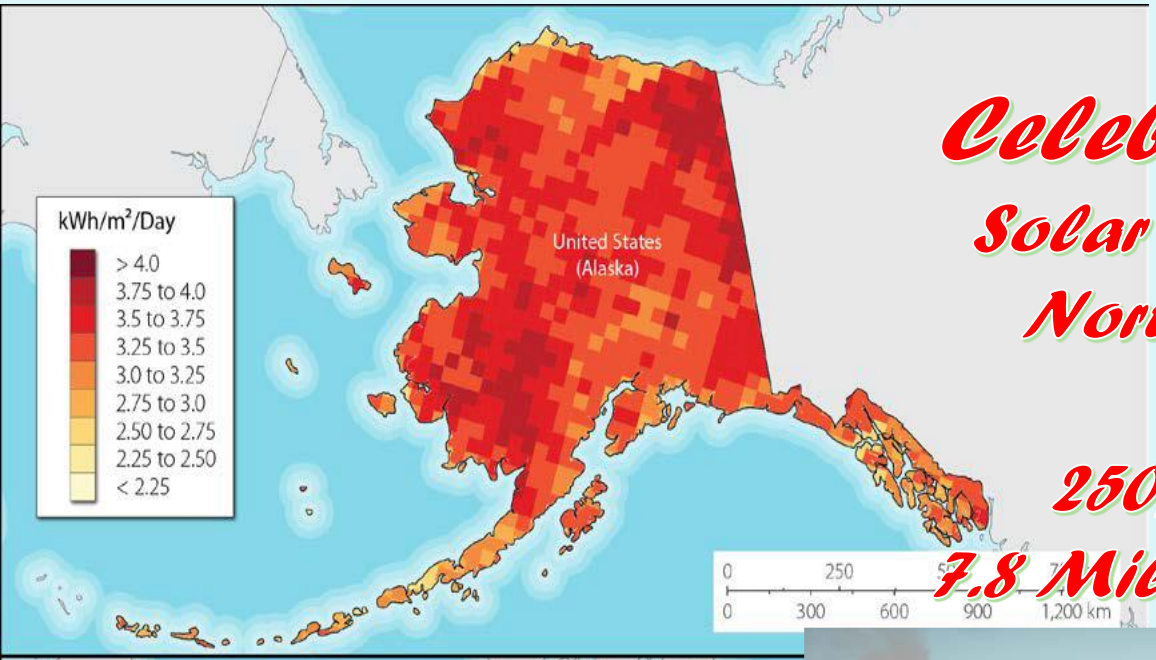
Photos: Northwest Arctic Borough

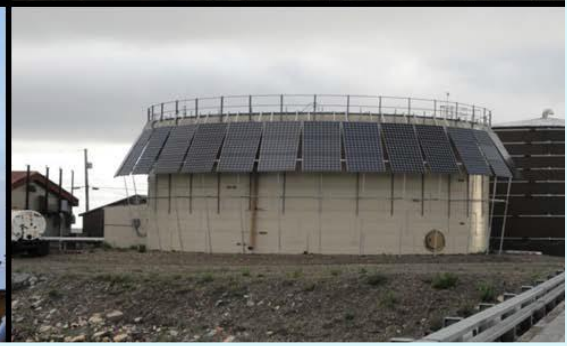
2022

Celebrating 10 Years of Solar PV development in the Northwest Arctic Borough 2013-2023

250,000 Gallons saved

7.8 Mil lb of CO2 not released





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 Peryear
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.

Value of utility size Solar arrays to the Households

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	0.5600	$ 112,00.00
Noatak Ut	275	250,000	$66,725.00	0.4868	$ 121,700.00
Noorvik Ut	23.4	23,400	$5,667.48	0.1685	$ 3,942.90
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
Kotzebue Ut	966	920,000	$ 220,800.00	0.18	$ 165,600.00

July 2017

Noorvik 23 Kw Utility array
80 Mwh produced so far
Saving 5,700 Gallons of Diesel so far

Nov 2018

Buckland & Deering Electric Utility Arrays 48.5 & 46 Kw
169 Mwh produced to date, saving 12,500 Gallons of Diesel so far

Courtesy
NANA

6/15/2020
Kotzebue Electric

Utility Array 576 Kw
Building out an additional 631Kw in 2023
822.47 Mwh produced to date,
saving 58,800 Gallons of Diesel

Courtesy
ANRI

9/26/2021

Shungnak-Kobuk IPP
233Kw/350Kwh Community Solar/Battery
273 Mwh produced to date,
Saving 19,500 Gallons of Diesel to date
And 818 Hours of Diesel off operation

Courtesy
ANRI

Transition to Village Independent Power Producers IPP's, 2020

So why develop Independent power producers

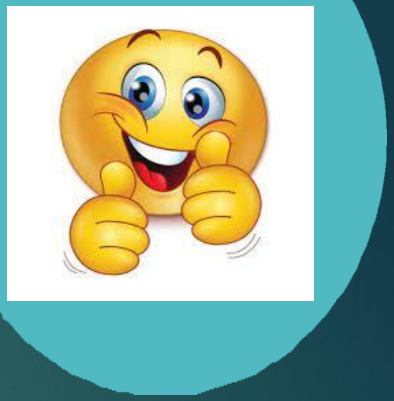
- The Communities taking control of their Energy future, developing their local resources. This creates buy in and good relationships with the utility.
- Being able to sustain PCE support to the communities and stabilize energy cost.
- Better economics, Circular economy
- Funding collected pays for further development and local workforce expertise. The money stays in the community instead of sending the money to far off countries for oil.

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
- (Small, single projects are too expensive).

- 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 and State wide Energy Policy.
- This creates Energy Security and is needed to stop the increasing cost of Energy and hedge against fuel increases and supply disruptions.

The Shungnak Solar IPP Project

Shungnak-Kobuk 223.5 DC/200 AC Kw Solar/battery PV array.
Using 550pc Bifacial 405W panels

Blue Planet environmentally friendly LFP Battery.
Capable of holding the two 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

Shungnak-Kobuk Solar IPP example

- **A Grant opportunity from USDA HECG was secured by the 2 Tribes by allowing NAB to apply on behalf of the Communities.**
- **The communities are interconnected with a power line so the proposed Solar project benefits both.**
- **Through an MOA a working agreement is executed between the 2 tribes to become an IPP (independent power producer)**
- **A power purchase agreement is executed with the utility AVEC.**
- **AVEC pays for the Solar power and recover the cost partly from the PCE fund.**
- **Another MOA is executed with NAB for help with admin and investment of funds.**
- **An Energy fund is established for the communities.**
- **Funds dispersed for insurance and maintenance and eventual further build-out of the Solar array.**

Alaska Tribes Recognized with Sunny Award for Equitable Community Solar

Congratulations! The DOE Solar Energy Technologies Office awarded a Sunny Awards Grand Prize to the Shungnak-Kobuk Community Solar Battery Independent Power Producer project, in Shungnak, Alaska.

This solar and battery project led by the Shungnak and Kobuk tribes in the Northwest Arctic Borough region aims to stabilize the cost of electricity and allow the communities to take charge of their energy future. The Shungnak project also received the 2022 Microgrid Project of the Year from *Solar Builder* magazine.

Following suit: Among current Office of Indian Energy projects, the Northwest Arctic Burrough 2021 Project with the Native Village of Noatak is emulating the Shungnak project and is making progress on a high-penetration distributed solar-battery hybrid system.

A Loud Shout-out to all Partners; USDA, Shungnak IRA, Kobuk IRA, NAB, NANA, AVEC, TECK, ANRI, AGETO, Blue Planet, Deerstone, Daylight services, Launch Alaska & others that contributed to the success of the project

Shungnak-Kobuk IPP 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

The Noatak Solar IPP Project 2023

Noatak 280.6 DC/250Kw AC Kw Solar/battery PV array phase 1.
Using 432 pc Canadian solar Bifacial 650 W panels
Expansion to 380.6 Kw available for phase 2.

Kronus/Pylontech LFP Battery 438.5 Kwh
Capable of holding the to communities for 2 Hours without Generators or Solar power.

Construction Sep 2022 to July 2023.

Total project cost $ 2,946,886.00
Funded by DOE Tribal grant @ $ 2,008,765.00
Denali Commission $ 134,079.00
Teck (Red Dog) $ 100,000.00
NANA VEI and inkind $ 309,998.00
In-kind VIF and NAB funds $ 394,123.00

The Selawik Solar IPP and REPOP

Selawik 130kw DC/100Kw AC Kw Solar/battery PV array phase 1.
Using 200 pc Canadian solar Bifacial 650 W panels
Expansion to 500 Kw available for phase 2.

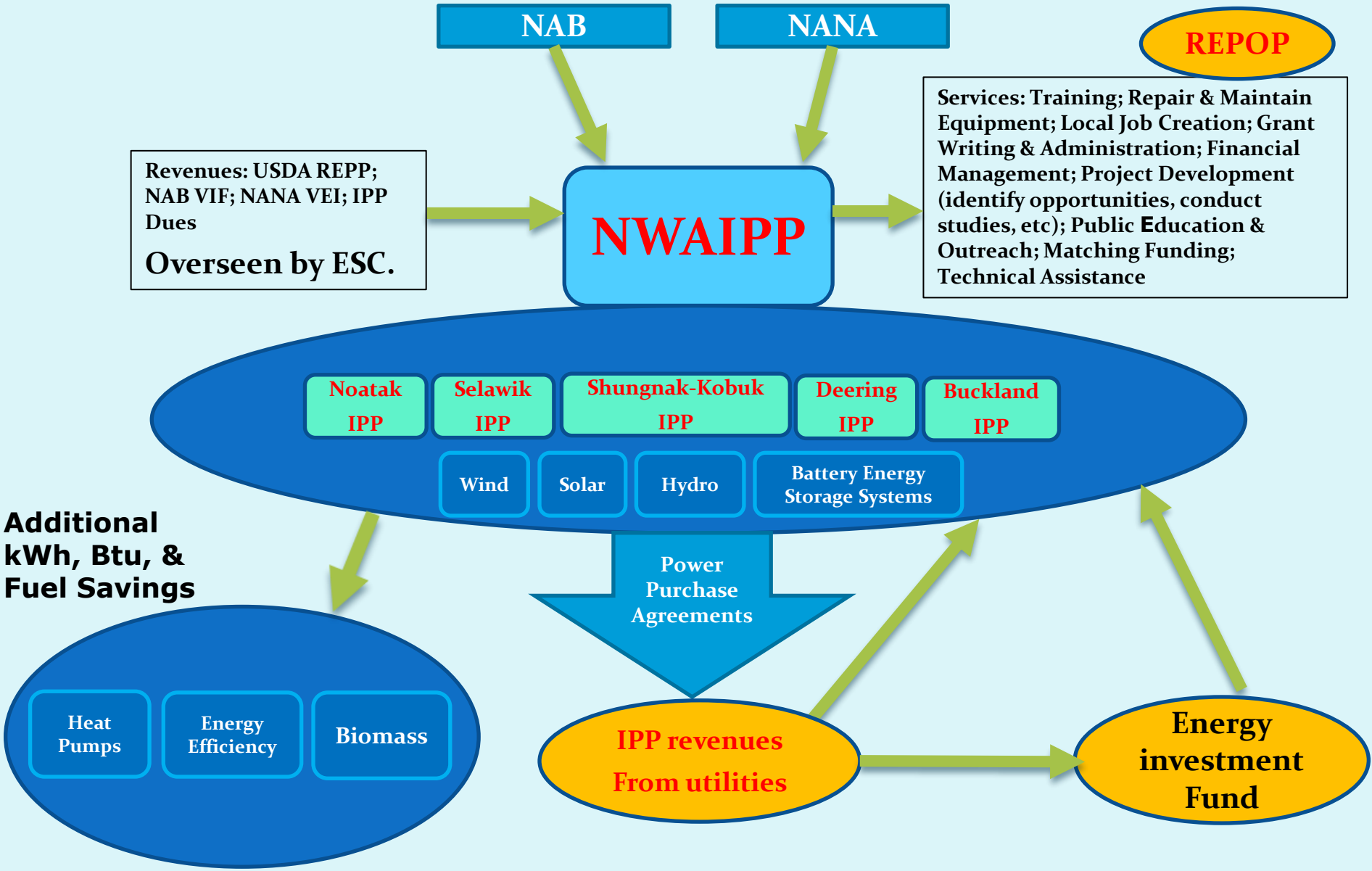
Blue Planet LFP Battery, 1 Mw
Capable of holding the to community for 4 Hours
without Generators or Solar power.

Start of construction Sep 2023 completion by July 2024.
Total project cost $3,611,190.00
Funded by USDA REPP @ $1,998,820.00
AEA REF 14 $ 250,000.00
AVEC $ 100,000.00
Teck (Red Dog) $ 100,000.00
NANA VEI and inkind $ 130,000.00
In-kind VIF and other NAB funds $ 1,032,370

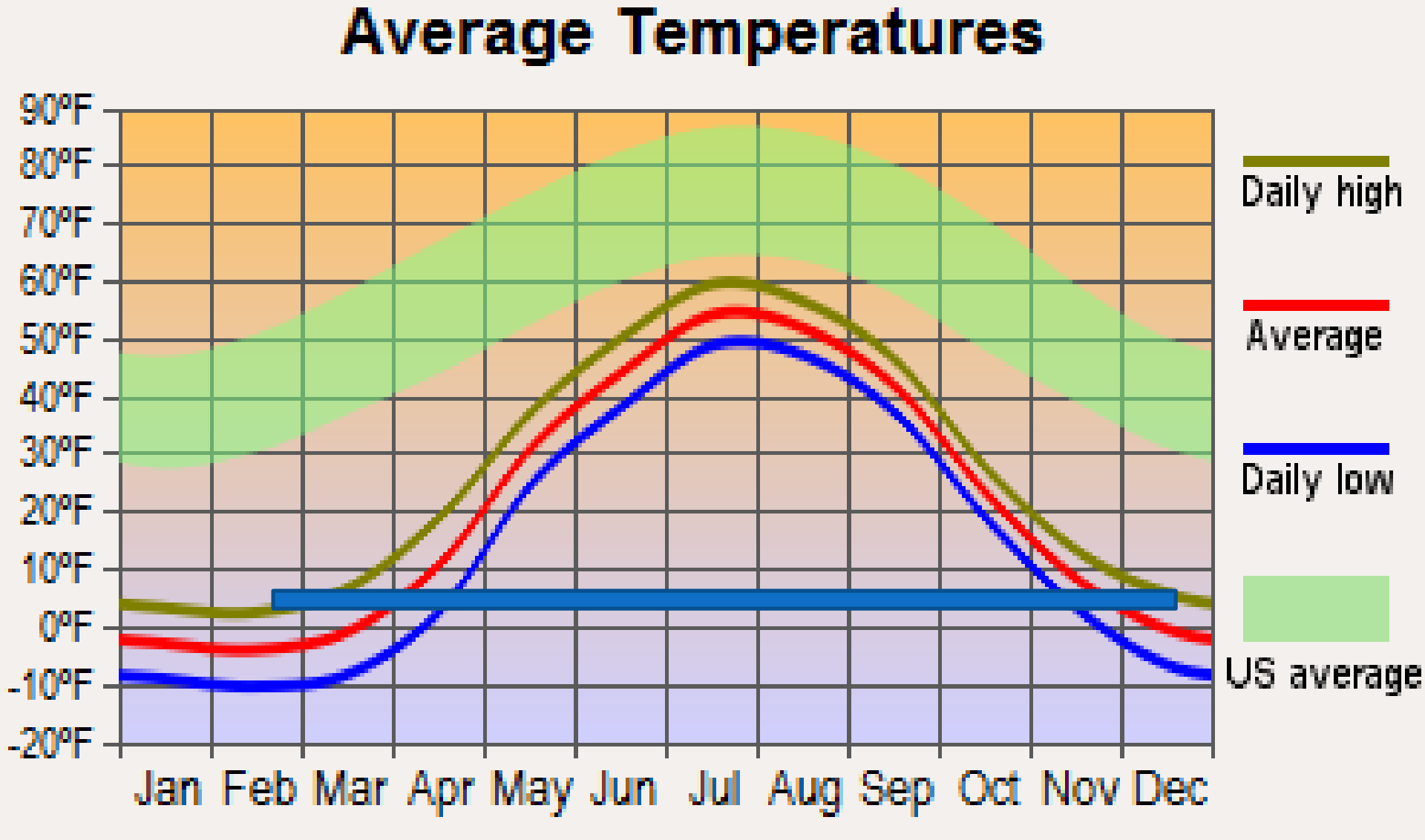
5 Year plan
Solar IPP's full build out

Community	Total			Total
	Solar PV	BESS	Combined	Diesel offset
	kW	MW	MWh/year	Gallons/year
Ambler	400	1	360	25,714
Buckland	450	1	405	28,929
Deering	250	0.5	225	16,071
Kiana	400	1	360	25,714
Kivalina	450	1	405	28,929
Noatak	550	1	495	35,357
Noorvik	550	1	495	35,357
Selawik	500	1	450	32,143
Shungnak-Kobuk	500	1	450	32,143
TOTALS	4,050	8.5	3,645	260,357

Regional IPP Organizational Structure

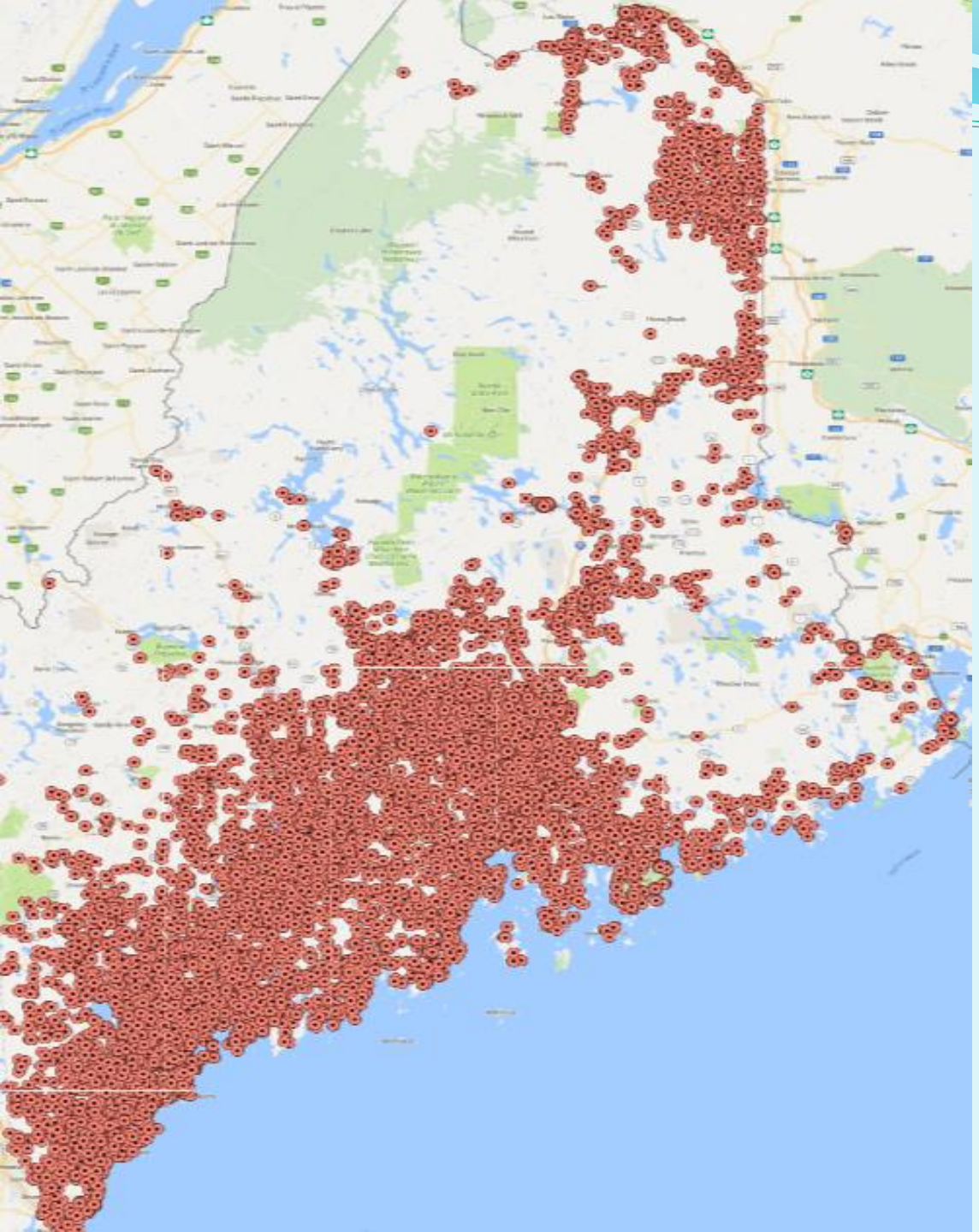


2016-17 Harvest season for Solar PV
Is the same as for Heat pumps



Heat-pump COP level for Diesel displacement
if cost of Electric-Diesel and cost of Heating fuel is the same

Break Even COP for Diesel displacement			
			COP
Toyostove:			2.43
Boiler:			2.42
Furnace, Standard Fan:			2.4
Furnace, Efficient ECM Fan			2.33



Map showing 17,500 ductless heat pump installations in the first 3.5 years.

Installation density correlates directly with population.

Very popular in far northern areas where systems are reported to continue to provide heat even at -27F.

Courtesy Efficiency Maine

Heat pump advantages

- **Low-cost heat** – The cost of heating with a heat pump is similar to heating with natural gas or wood. This is typically half the cost of heating with oil, kerosene, electric baseboard or propane to compare heating costs of different heating systems.

- **Low-cost air conditioning** – Today's best heat pumps are twice as efficient as typical air conditioners.

- **Comfort** – With advances in controls, heat pumps can maintain very constant temperatures.

- **Safety** – Because heat pumps are electrically powered, there is no risk of combustion gas leaks.

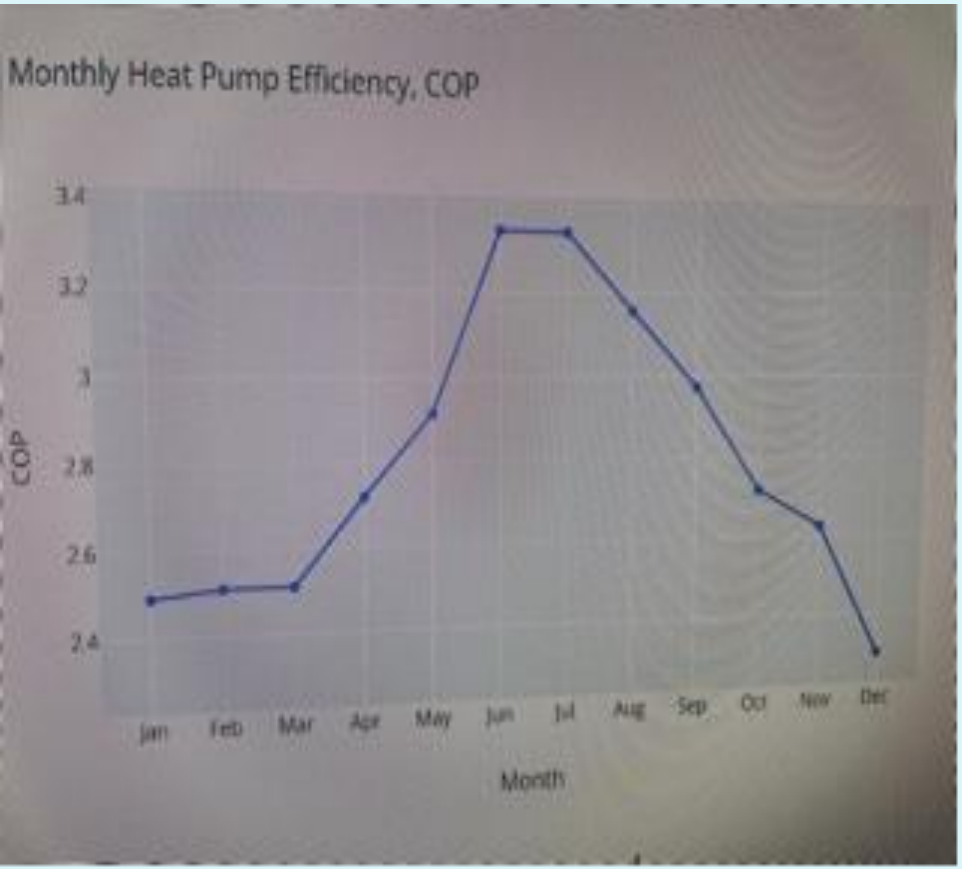
- **Air quality** – Heat pumps filter air as they heat/cool/dehumidify it.

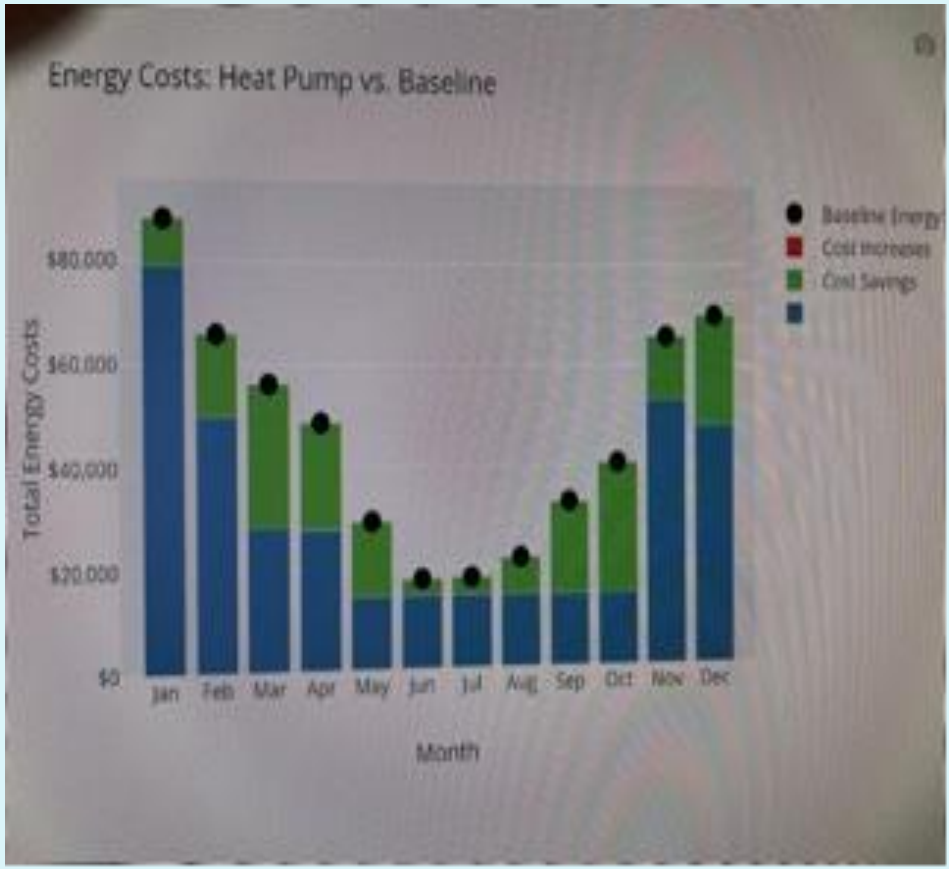
- **No CO_2 emissions** – Cleaner environment and resilience to Global Warming.

13 Air to Air Heat-pump installations
Pilot Project- CIAP Funded 2017-18.
Panasonic MHP MXZ4C36NA2-U1

Cooling tent for Meat

COP curve and cost savings According to Heat-pump Calc.





All Alaska Online Calculator

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NANA

FOR THE COASTAL AND INLAND PEOPLES
INCORPORATED SEPTEMBER 18, 1974

AP&T

AVEC
ALASKA VILLAGE ELECTRIC COOPERATIVE

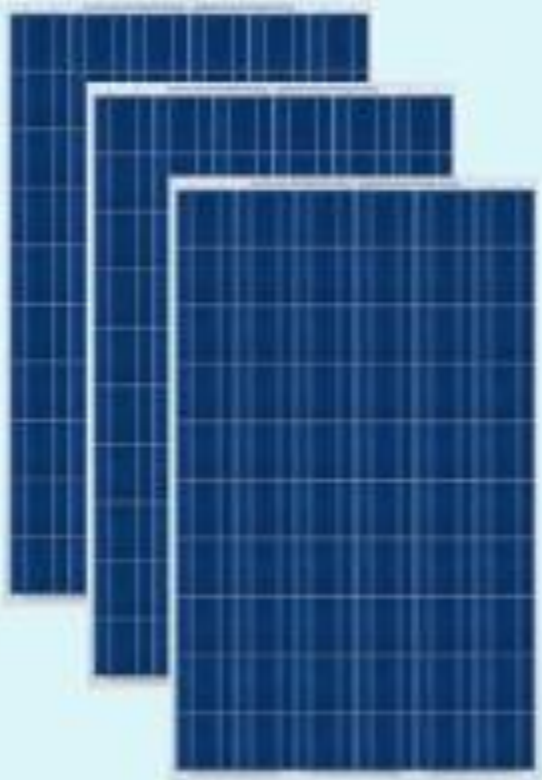
Web access @ https://heatpump.cf/

The Calculator has been updated with the latest Fuel and electric rates and additional new Heat-pump models

Here are some results from Ambler average size House

Heat-pump; Low temp. Mitzubishi HI-Heat single zone 38,000 BTU
Annual Heating Fuel Savings: 463 gallon of #1 Oil
Annual saving: $ 2,500/year @ $ 12.36/G Fuel cost
Savings over 14 Year life: $ 35,065

DC4812VRF Solar/DC Mini split Air Conditioner/heater



Pilot Energy Efficiency Project for Ambler

12,000-38,000 BTU 48V DC Heat Pump VRF Dynamic Capacity Compressor 100% DC - No Inverter with AC backup

65 Households out of 68 Completed in Ambler July 2021.

1 Kw of Solar for every Household

Data to be collected 2021-2022

Ambler VPSO Building & House installations.

The Energy Steering Committee
15 Years and Going 2009-2023

Goals and lessons learned

- **Make a sustained effort, realize that changes comes slowly with understanding of new ways and operation.**

- **Continue to work with the Regional Energy Plan**
- **It is the "Vision" for the future, from the people for the people.**

- **Make sure the document gets updated periodically as it is a "Dynamic" living document and needs to be able to "Adapt" to changes when new thinking and resources comes along.**
- **Hopefully it will never be completed.**

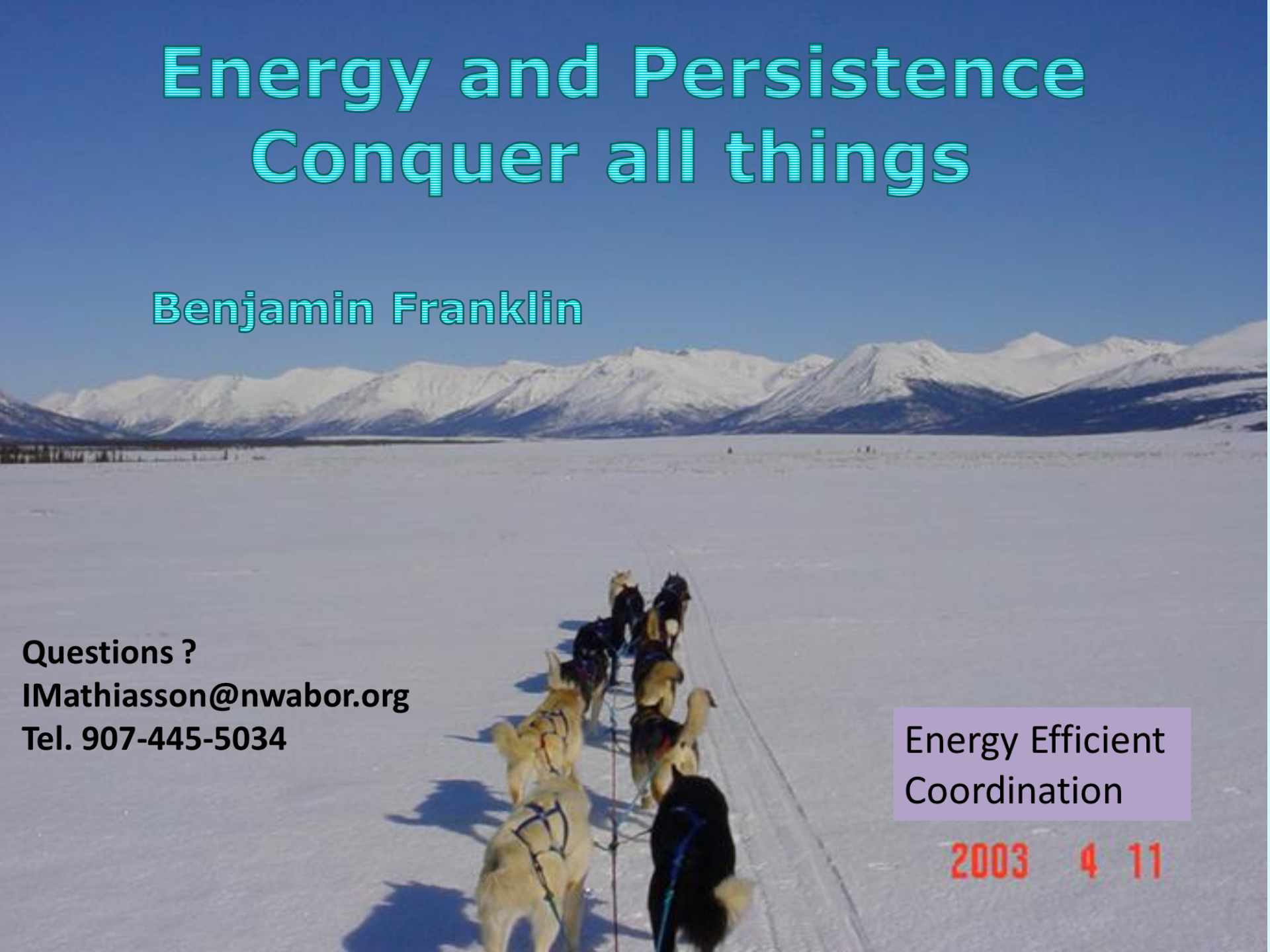
Energy Policy

- **Do we develop Energy resources for short time profits ?**

- **Or do we develop Local Energy resources that can sustain the Region for the foreseeable future and create a cleaner environment for our Children ?**

Energy and Persistence Conquer all things

Benjamin Franklin



Questions ?
IMathiasson@nwabor.org
Tel. 907-445-5034

Energy Efficient Coordination