ALASKA VILLAGE ELECTRIC COOPERATIVE

ARCTIC MICROGRIDS IN THE USA

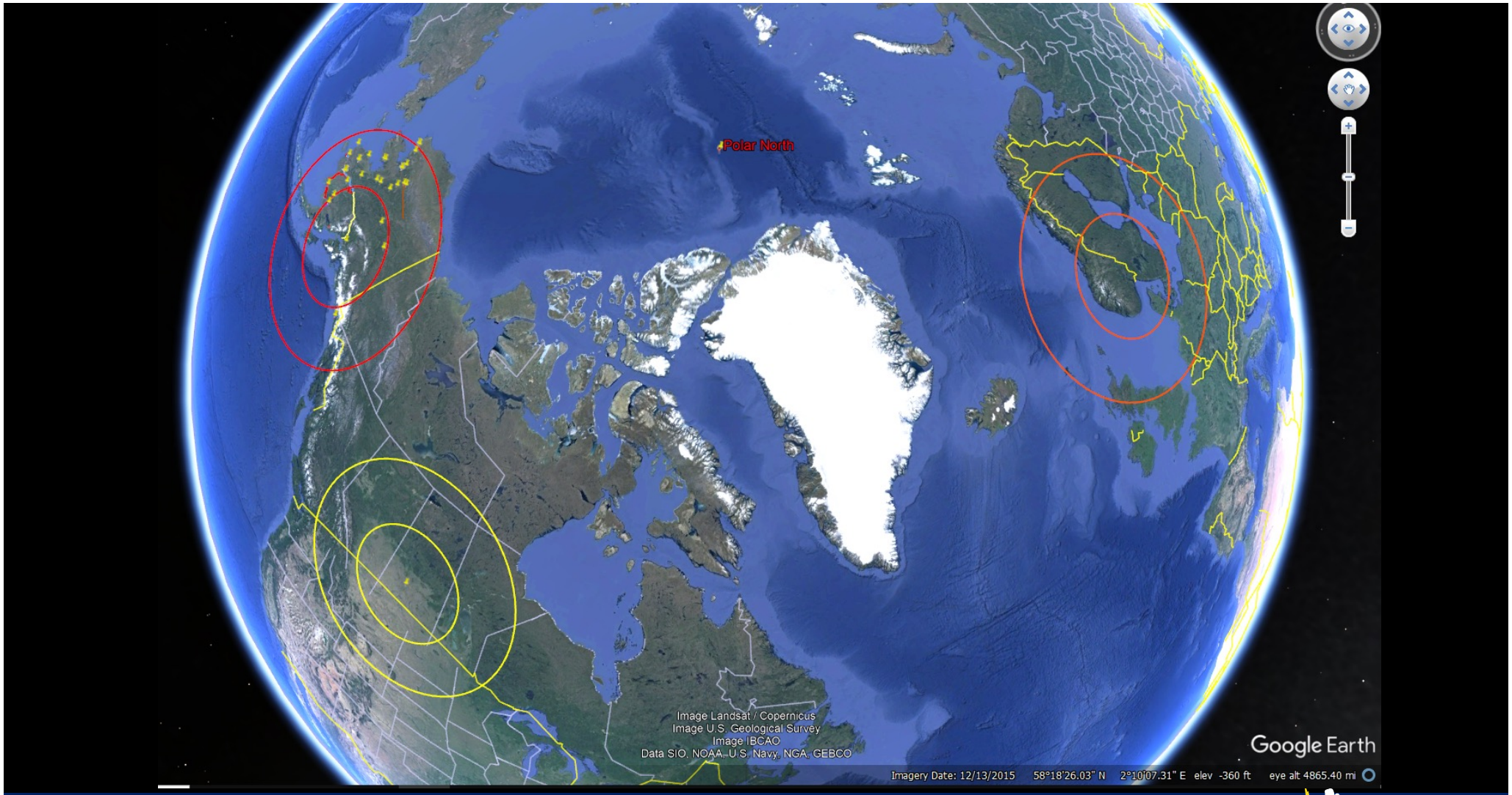
INTERNATIONAL ENERGY FORUM

SASKATOON, SASKATCHEWAN CANADA

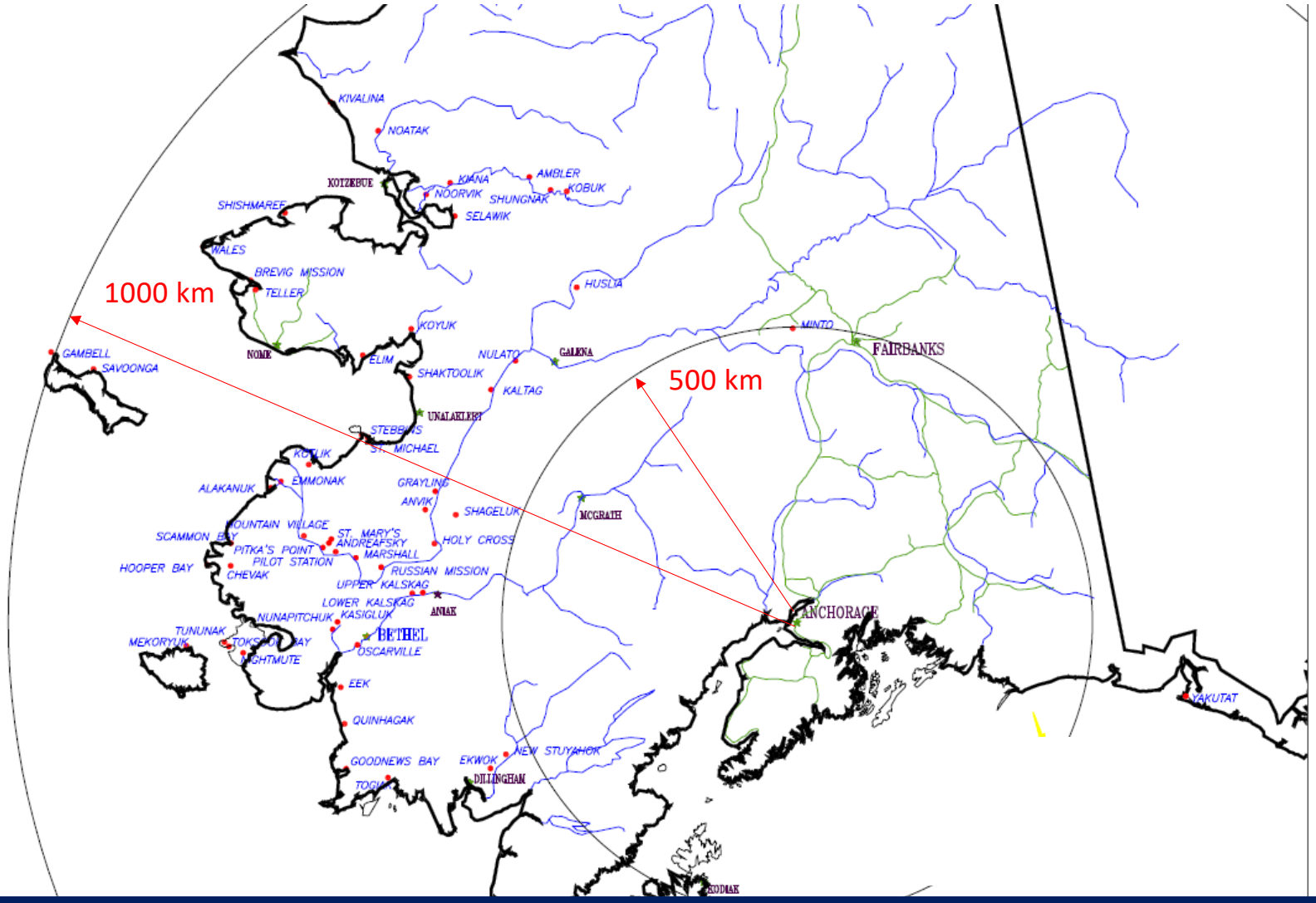
MAY 15, 2024

Savoonga, AK

Bill Stamm President & CEO


Polar North
Image Landsat / Copernicus
Image U.S. Geological Survey
Image IBCAO
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Google Earth
Imagery Date: 12/13/2015 58°18'26.03" N 2°10'07.31" E elev -360 ft eye alt 4865.40 mi

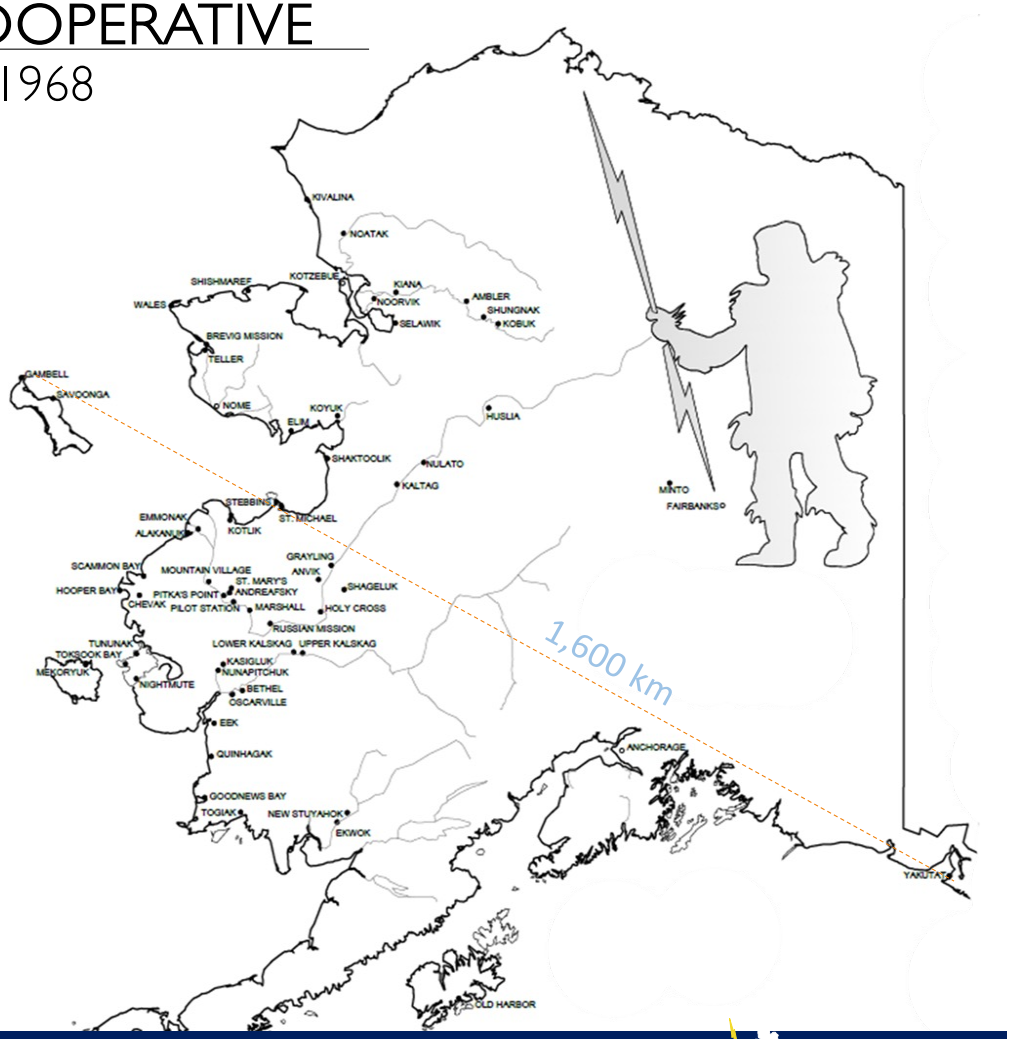
AVEC


1000 km
500 km
KIVALINA
NOATAK
KOTZEBUE
KIANA
AMBLER
KOBUK
NOORVIK
SHUNGNAK
SELAWIK
SHISHMAREF
WALES
BREVIG MISSION
TELLER
HUSLIA
MINTO
FAIRBANKS
KOYUK
NOME
ELIM
NULATO
GALENA
GAMBELL
SAVOONGA
SHAKTOOLIK
KALTAG
UNALAKLEET
STEBBINS
ST. MICHAEL
KOTLIK
EMMONAK
ALAKANUK
GRAYLING
ANVIK
SHAGELUK
MCGRATH
MOUNTAIN VILLAGE
SCAMMON BAY
ST. MARY'S
ANDREAFSKY
HOLY CROSS
PITKA'S POINT
MARSHALL
PILOT STATION
HOOPER BAY
CHEVAK
RUSSIAN MISSION
UPPER KALSKAG
LOWER KALSKAG
ANIAK
NUNAPITCHUK
KASIGLUK
ANCHORAGE
TUNUNAK
BETHEL
MEKORYUK
OSCARVILLE
EEK
QUINHAGAK
YAKUTAT
NEW STUYAHOK
GOODNEWS BAY
EKWOK
DILLINGHAM
KODIAK

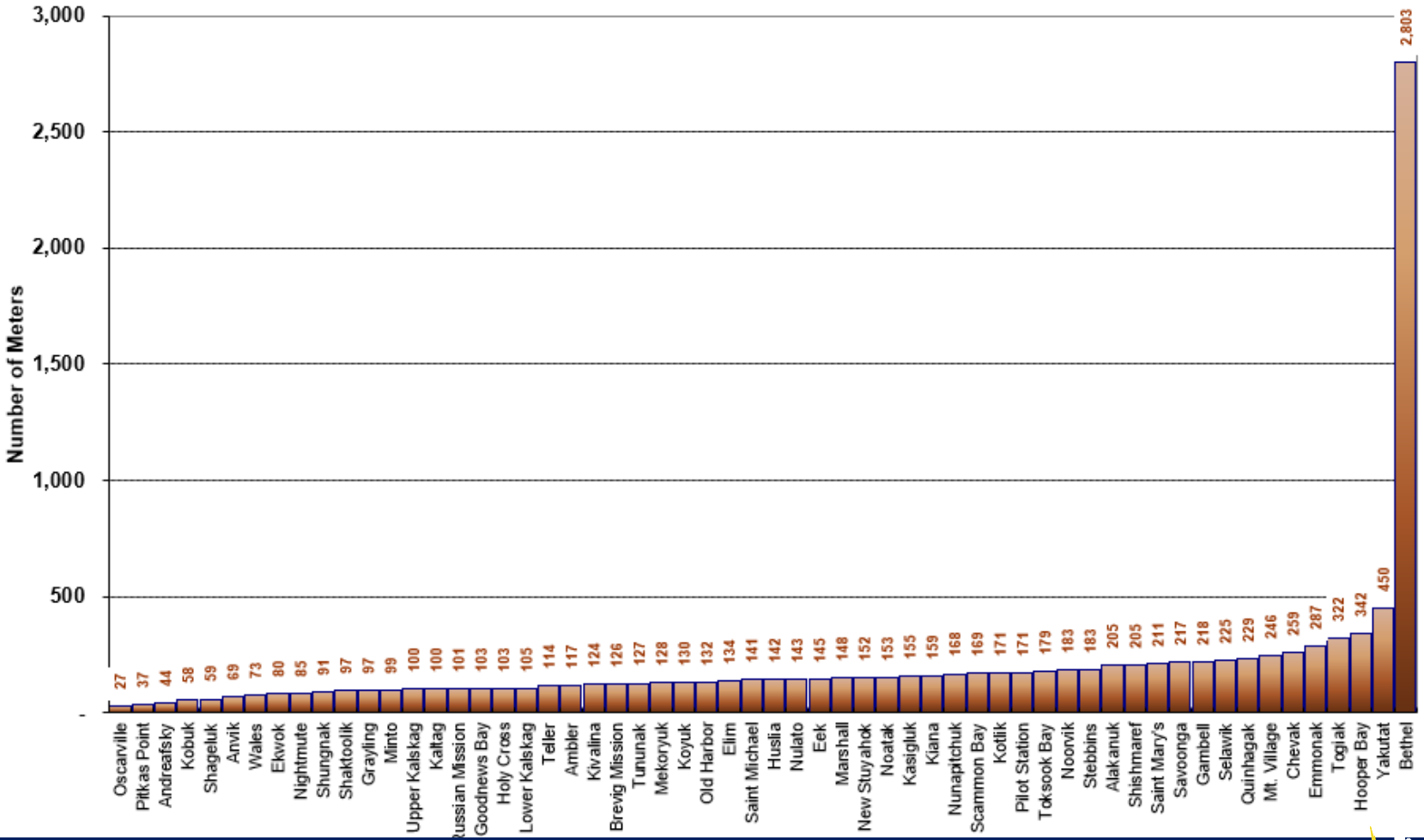
ALASKA VILLAGE ELECTRIC COOPERATIVE

Energizing Rural Alaska since 1968

- Nonprofit 501(c)12 -Electric Cooperative
- 58 Rural Communities, 31,000+ Residents
- 46 Prime Power Plants, 8 Standby Plants
- 162 Diesel Generators
- 35.2M Liters of Diesel in 2023 ($43.8M)
- 830 km of Distribution Lines
- 13 Wind Sites, 33 Wind Turbines, Serving 22 Communities
- $74.0M Annual Revenue
- 2023 Total Electricity Sold 126.2 MWh



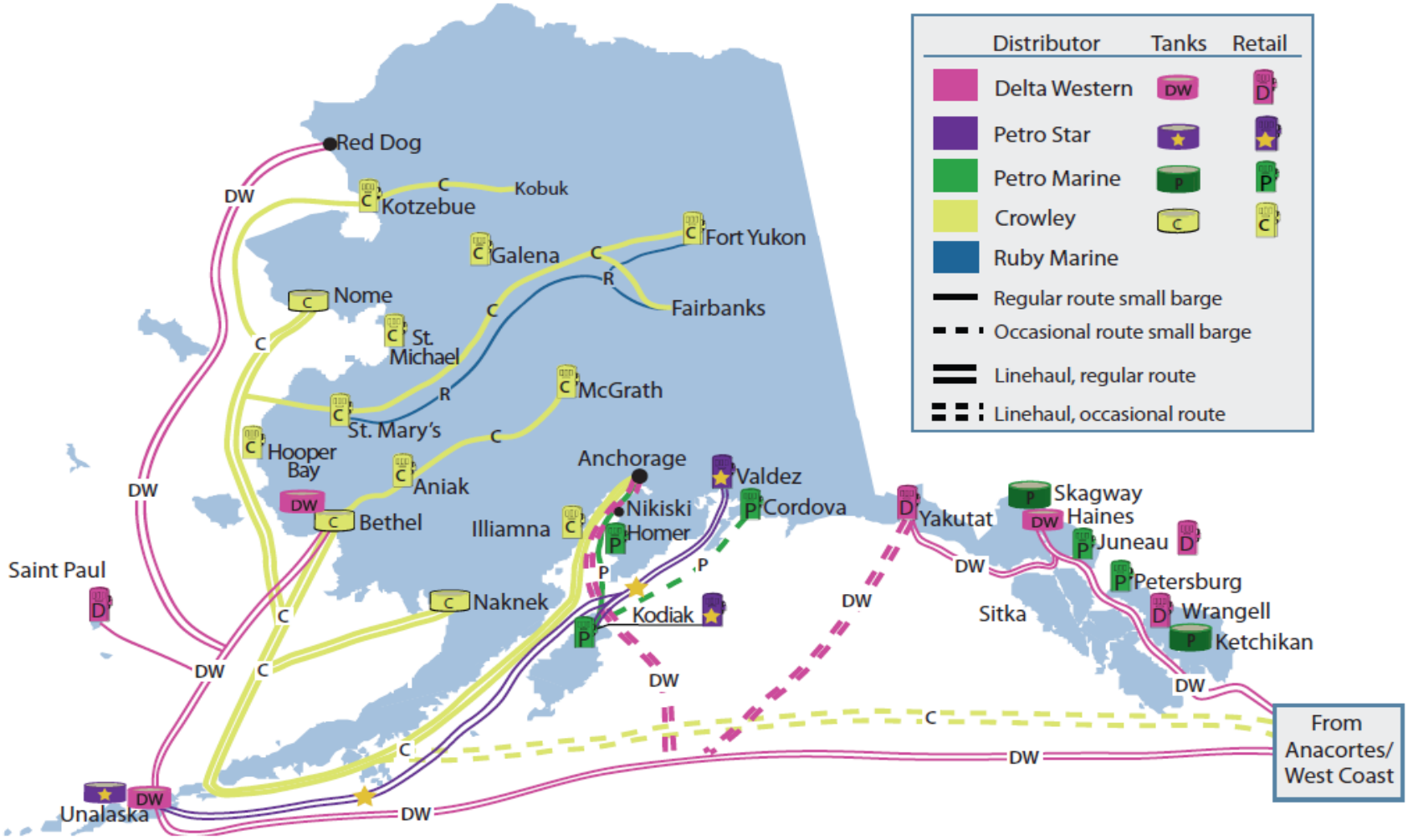
Relative "Size" of Community by Meter Count




Toksook Bay, Alaska
Toksook Bay, Tununak, Nightmute:
Average Load 420kW
Peak Load 750kW
AVEC

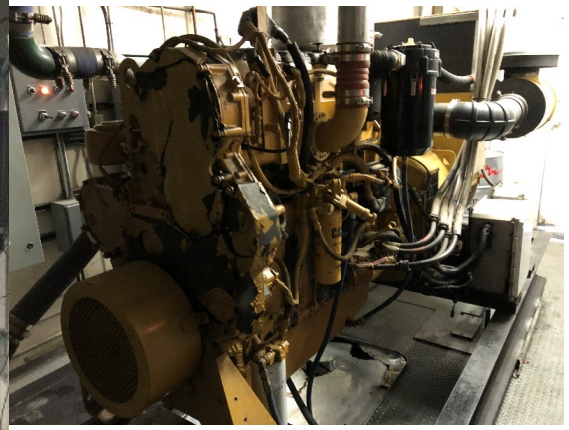
Most of the energy used for POWER and HEATING in rural Alaska is delivered through a 3” diameter hose.

Togiak, AK

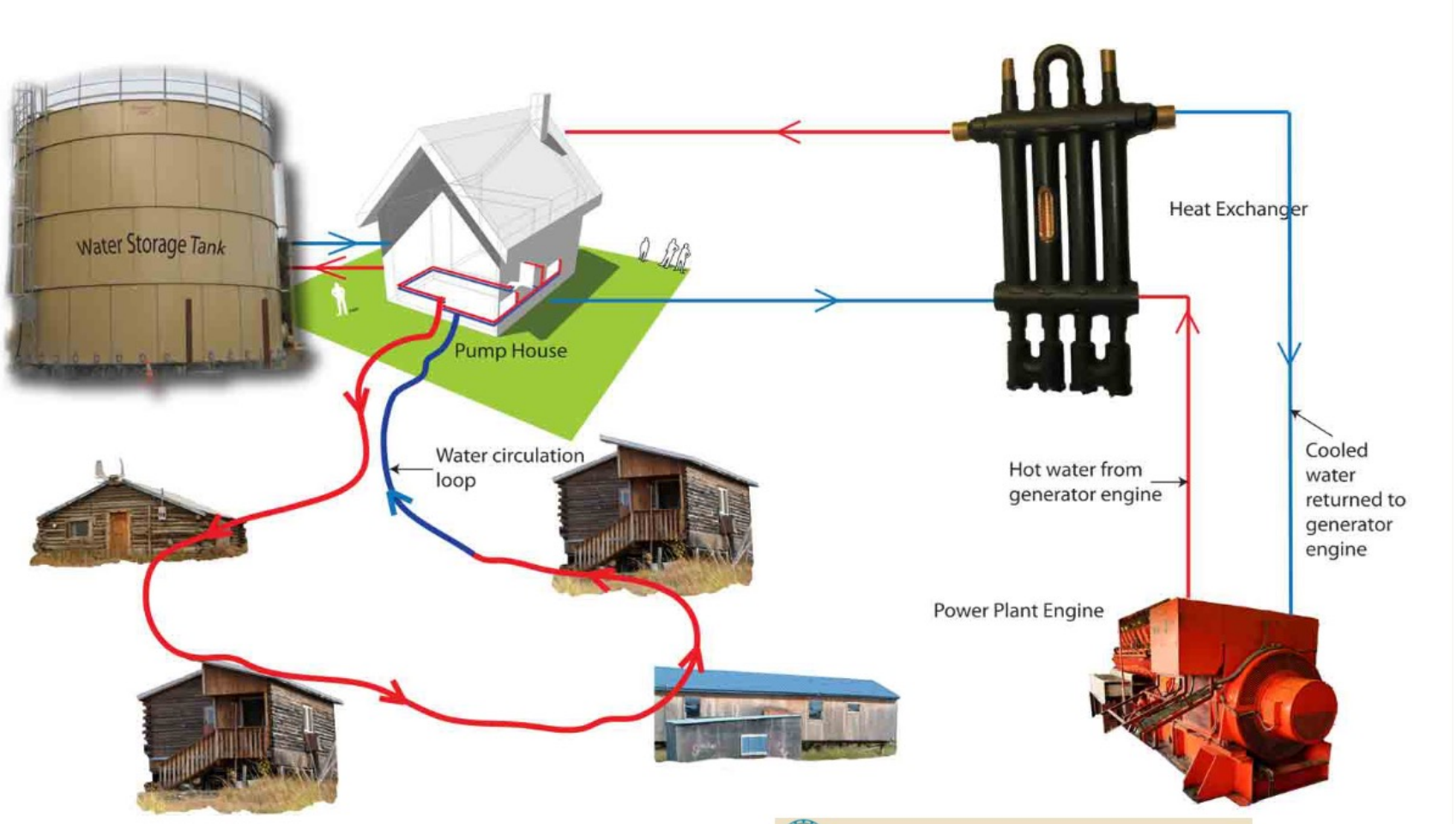

Distributor
Tanks
Retail
Delta Western
Petro Star
Petro Marine
Crowley
Ruby Marine
Regular route small barge
Occasional route small barge
Linehaul, regular route
Linehaul, occasional route
Red Dog
Kotzebue
Kobuk
Galena
Fort Yukon
Fairbanks
Nome
St. Michael
McGrath
St. Mary's
Hooper Bay
Aniak
Bethel
Anchorage
Valdez
Cordova
Nikiski
Homer
Illiamna
Naknek
Kodiak
Saint Paul
Unalaska
Yakutat
Skagway
Haines
Juneau
Petersburg
Wrangell
Ketchikan
Sitka
From Anacortes/ West Coast
DW
C
R
P

BULK FUEL STORAGE

GENERATION FACILITIES



HEAT RECOVERY for COMMUNITY WATER

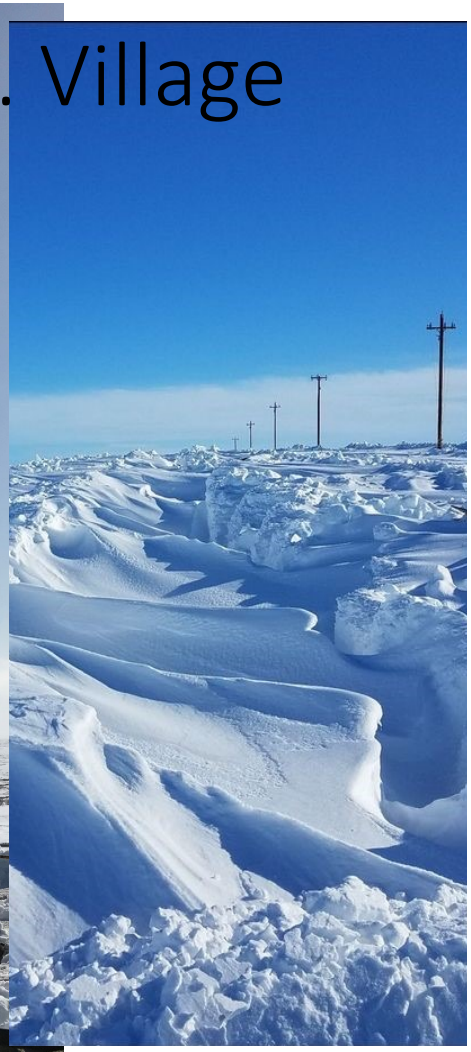


28 of 58 AVEC communities utilize recovered heat from diesel generation

ALASKA NATIVE TRIBAL HEALTH CONSORTIUM

Distribution Facilities

20 Mile Intertie from St. Mary's to Mt. Village



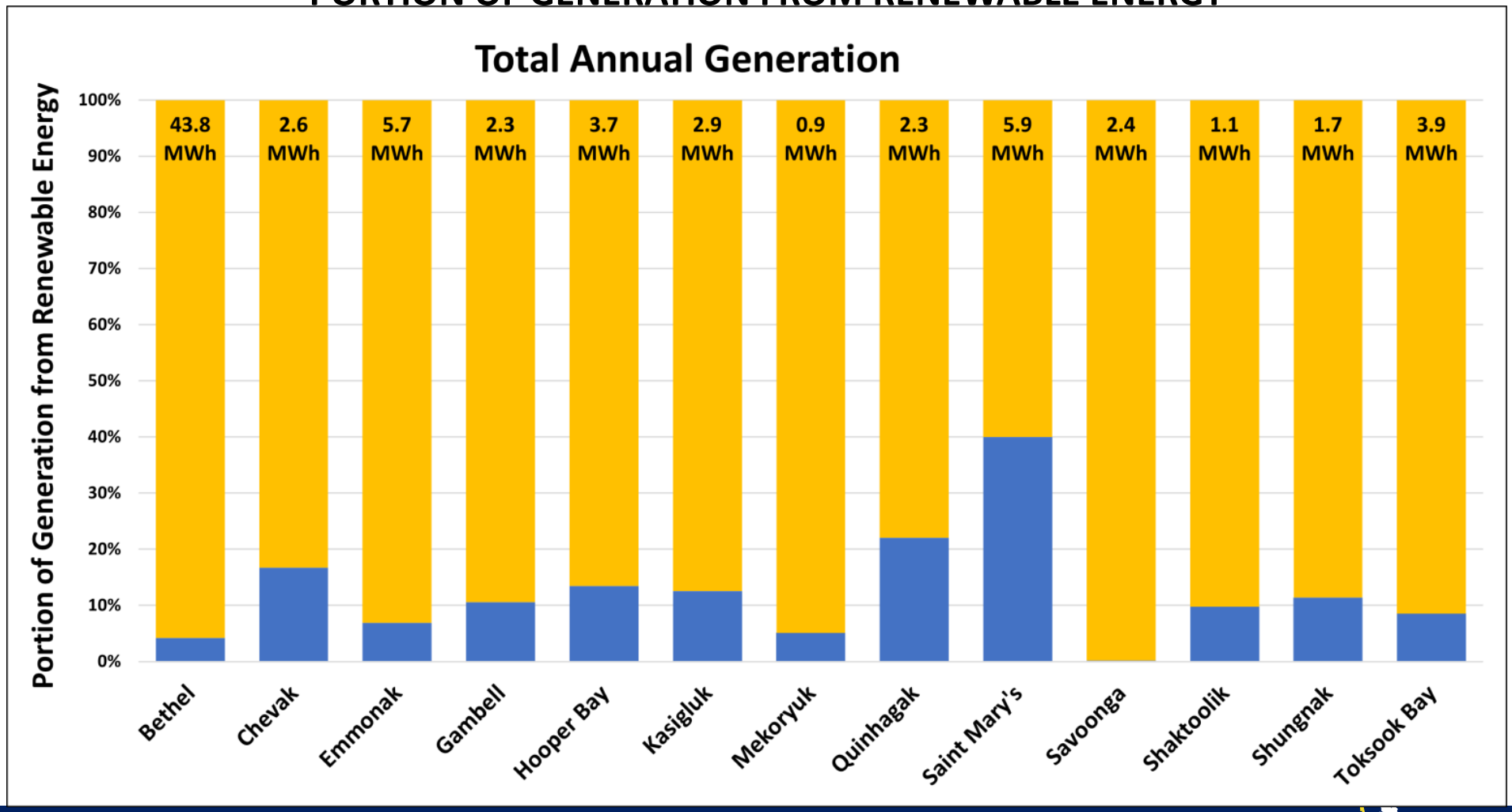
GRANT FUNDED CAPITAL IMPROVEMENT PROJECTS

Togiak- Average Load 340 kW
Peak Load 490 kW

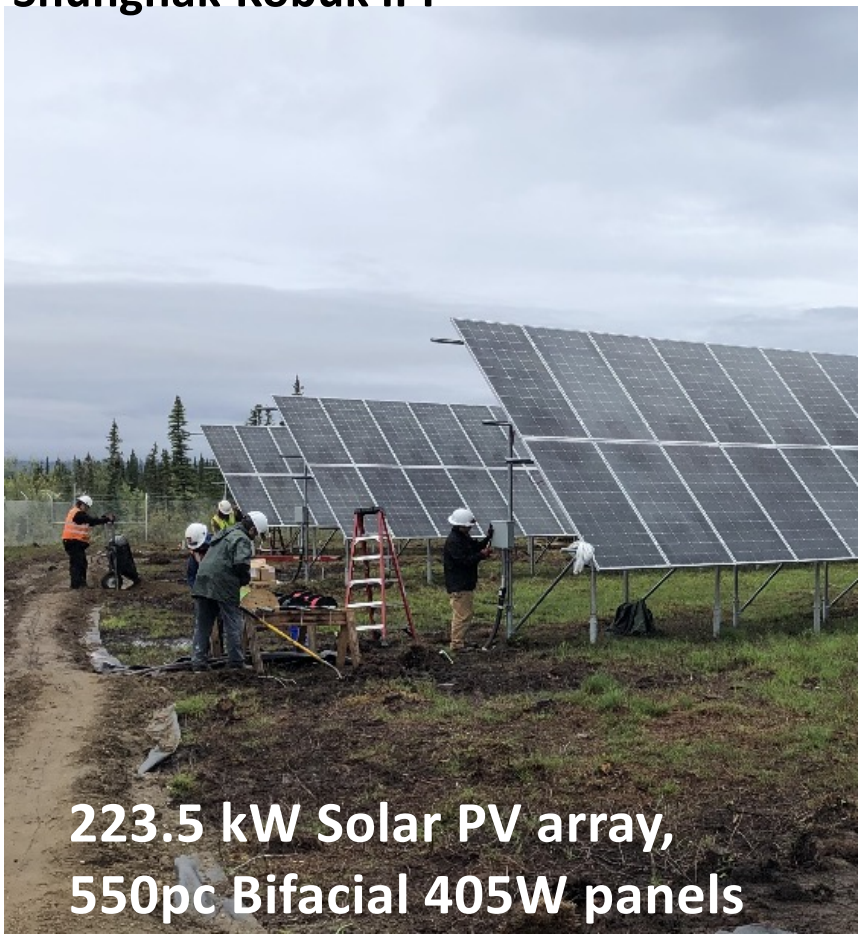
Renewable Generation Integration on Micro-Grids

AVEC'S TIMELINE OF RENEWABLE ENERGY PROJECTS 1999-2023

PORTION OF GENERATION FROM RENEWABLE ENERGY



Shungnak-Kobuk IPP



Renewable Readiness – Switchgear Replacement

Power from the sun displacing 10-15% of diesel use for the community

Sunrise over the Shungnak Solar Array –

Thank you,

Innovations

Existing

- Optimizing diesel performance with electronically controlled, turbo charged diesel gensets with combined cooling systems, heat recovery and automated dispatch
- Secondary load control to stabilize variable wind impact on small grids
- Grid Bridging System- Short duration energy storage for wind-diesel support
- Integrating locally owned (3rd-party) Solar/Battery systems with controls for diesels-off generation

Near term:

- Adding supplemental electric heat to power plants to extend diesel-off season
- Install 10-mile MVDC distribution proof-of-concept power line
- Adding broadband with store and forward edge device, SCADA and security firewalls
- Inventory of hydro-kinetic resources for all communities