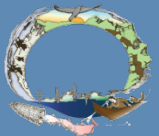


# **Sustainable Solar Energy for Hughes Village Council, Hudotl'eeekkaakk'e Tribe**

**A project to increase energy security and tribal resiliency in Hughes Alaska**

**Dave Messier**  
**TCC Infrastructure Division Director**

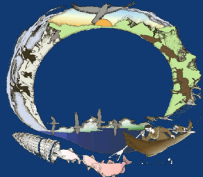


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# Hughes, Alaska

- Koyukon Athabascan community
- 210 Air miles northwest of Fairbanks
- Fly in Only for Fuel using DC4's built in the 50's and 60's

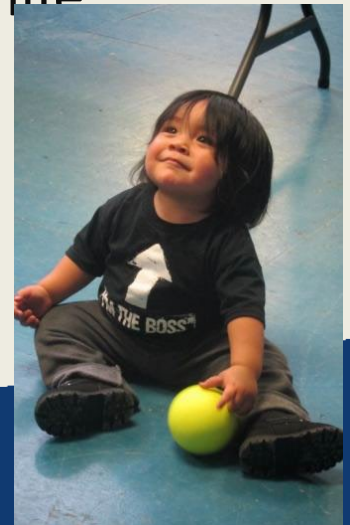


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# Hughes, Alaska – Community Vision

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“We are a community who value their subsistence way of life, our children and elders, and our healthy lifestyles. We will take direction from our elders through hands-on learning and story-telling. We are preparing our next generation to continue our work. We approach our work with open minds and open hearts and the intention to build a community that is designed by its members to be a place safe from floods and reflective of our values and our lifestyles. We are continuously seeking a higher quality of life ”



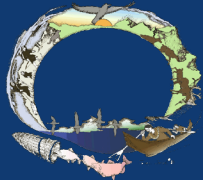


# Community Planning Progress

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Community Planning Initiated in 2002, Successes:

- Construction of new teacher housing (Completed)
- Construction of outdoor basketball court (Completed)
- VHF Radios for residents (Completed)
- Completion of a new landfill (Completed)
- Biomass Heating Project (Completed)
- Reduce Reliance on Imported Diesel fuel for electric generation (ongoing, Thanks DOE!)



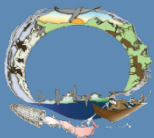
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# Renewable Portfolio Standard

## Renewable/Efficiency Portfolio Standard:

**“NOW THEREFORE BE IT RESOLVED** that the city of Hughes, Alaska and the Hughes Tribal Council recognize the importance of communities working together to improve their energy situation...[and] that these entities choose to establish a goal of 50% diesel displacement in our community by the year 2025....meaning that 50% of the electricity generated and sold by the local utility will be from renewable energy sources”



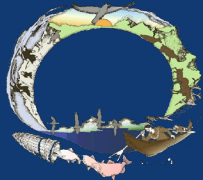
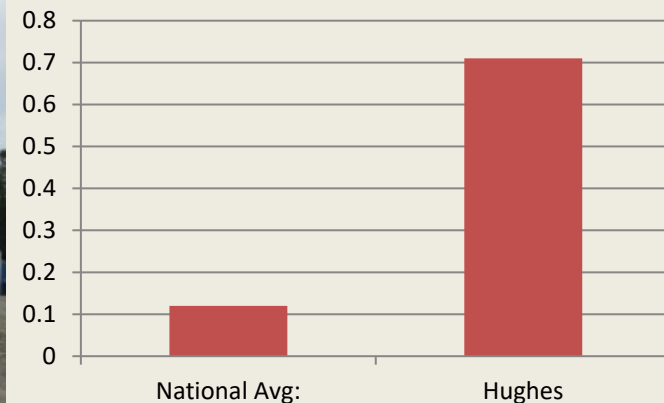
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*“Stronger Together  
for the Next 100 Years”*

# Where does YOUR Electricity come from?



\$/kWh Hughes Vs. National Avg

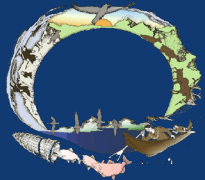
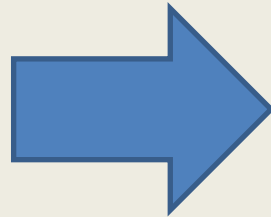


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# The Challenge?

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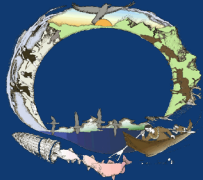
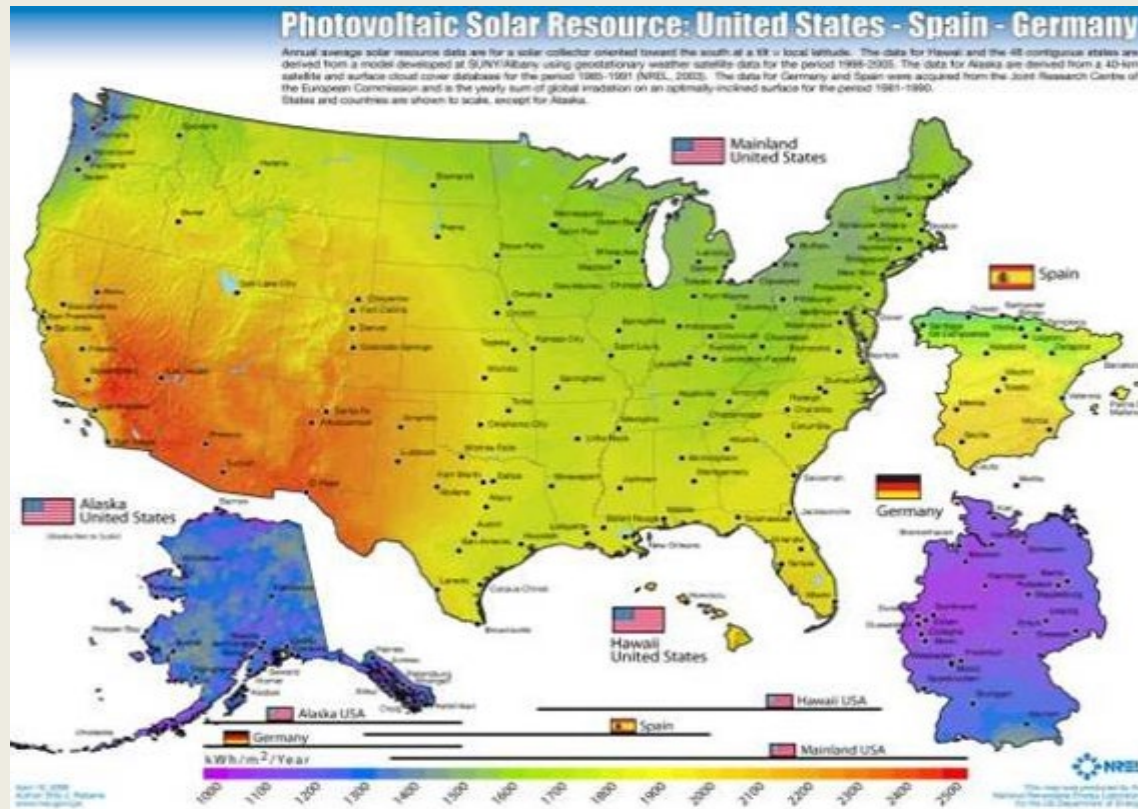
How do we get Hughes from  
HERE... To ...HERE



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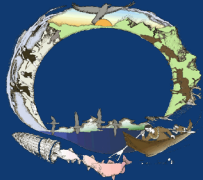
# But wait a sec, I thought Alaska didn't have much sun?



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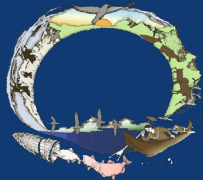
Did we mention the DC 4's...



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# Hughes Plant Operators and Gensets

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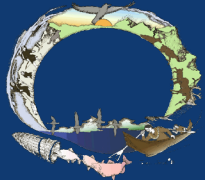


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# Project Goals

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1. Increase Tribal Energy Security and Resiliency
2. Development of a replicable PV-Diesel hybrid electrical system that can be deployed in other villages
3. Implement a financial model that allows tribal ownership, reduces energy costs and does not negatively effect the PCE contribution to electric rates



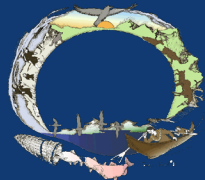
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# TANANA CHIEFS CONFERENCE



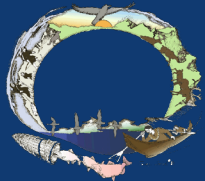
# Community Wide LED Lighting Upgrade



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# Site of Solar PV Array 2017

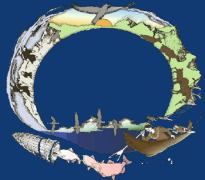
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# Site of Solar PV Array 2018



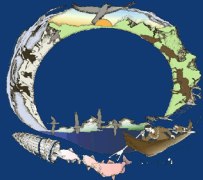
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# Solar PV Array 2018

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Oct 30<sup>th</sup> 2018 Hughes, AK North of the Arctic Circle



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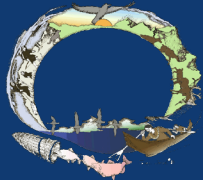




# Summer 2019 Wiring PV Panels



***Hughes PV Array Panels-Inverter \$2.10/watt***

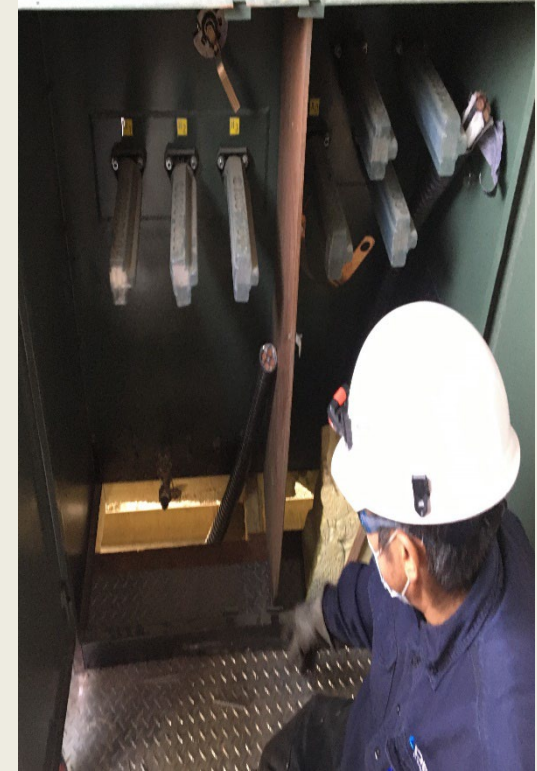


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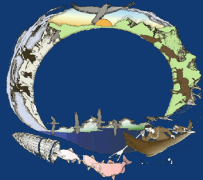




# Summer 2020 Battery Shelter

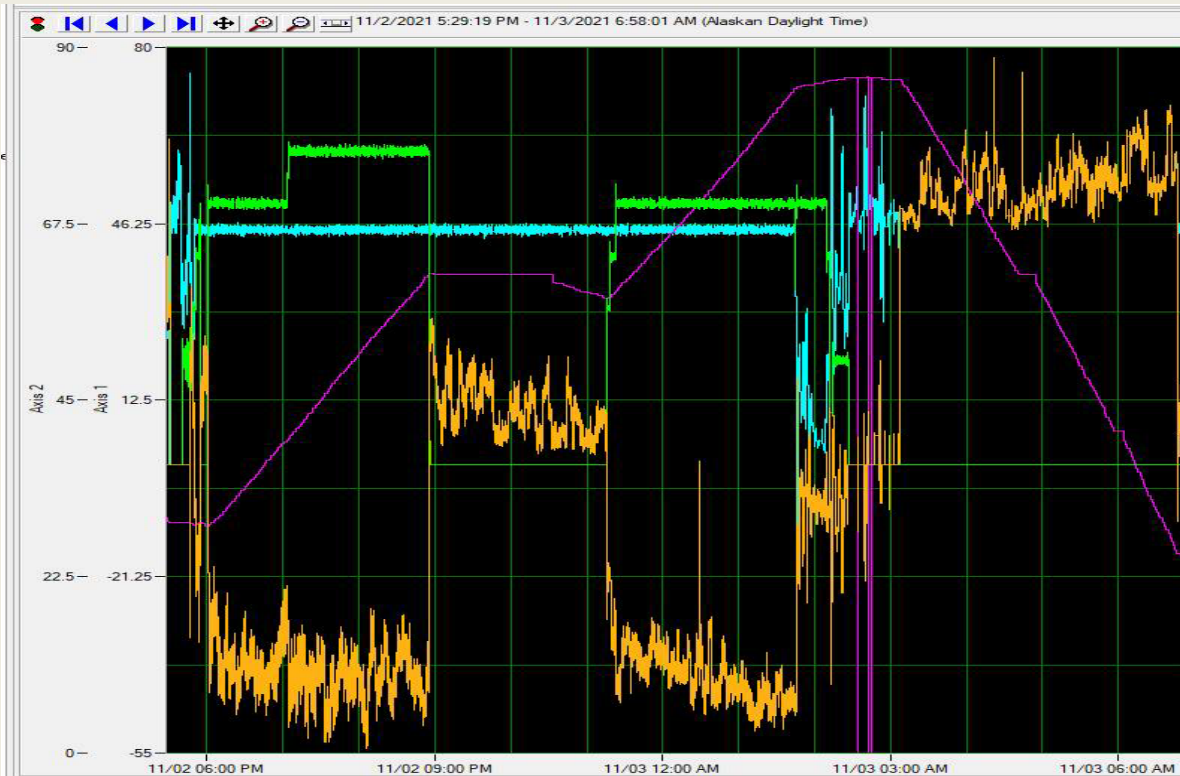


***Hughes 250kw/335kWh ABB Emesh unit inside Quonset Hut***



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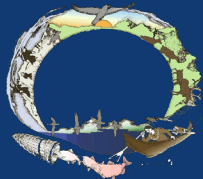
# 2021 – HUGHES VILLAGE RAN “DIESELS OFF” and nobody lost power!!



***Caption: this is a bunch of gyrating lines***

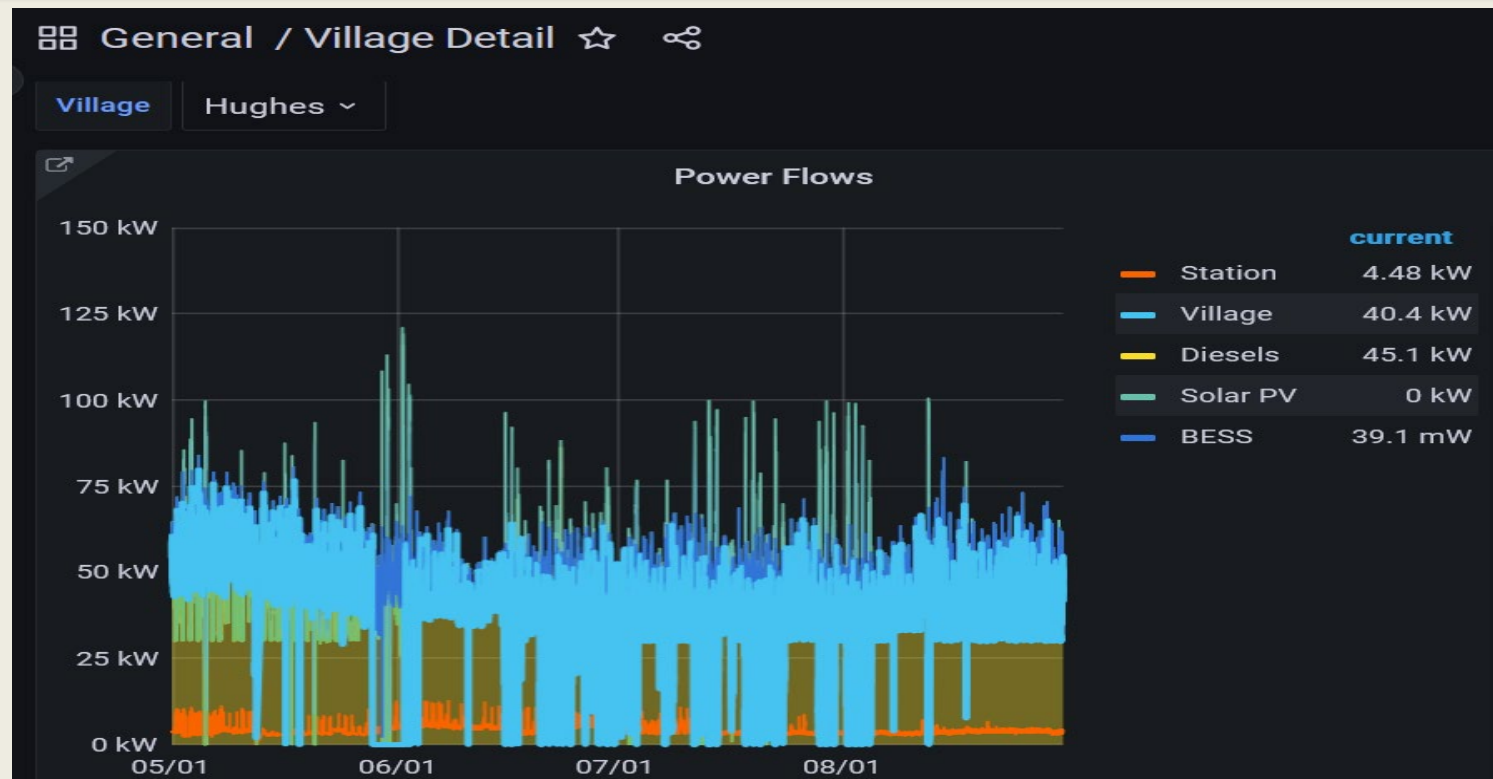


***Caption: self portrait, Dave  
Messier 11/3/21 approx 10am  
(Alaskan Daylight Time)***

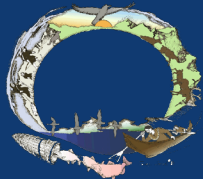


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June 16<sup>th</sup> 2022: Chief Beetus called “hey ... err Dave... I just drove by the powerhouse, there’s no generators running, but all the lights are on... is that solar working?”



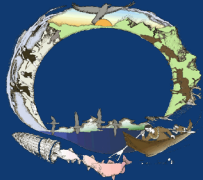
*Caption: blue = Solar*



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# Logistics...



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# Project Logistics

Material Cost of Racking and Solar PV Panels: \$102,000

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Cost of Shipping: \$15k SEA → Nenana + \$15k Nenana → Hughes

Racking From Ohio →

Trucked to SEA →

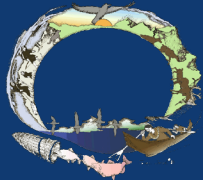
Barged to ANC →

Trucked to NEN →

→ Barged 450 miles down the Yukon Tanana and Yukon River and 400 miles up the Koyukuk River

Installed Cost w/shipping: \$2.10/watt

Installed Cost w/out shipping \$1.84/watt



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# ABB E-Mesh 250/335

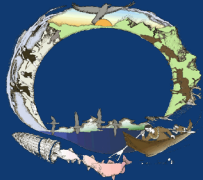
MICROGRID AND ENERGY STORAGE SOLUTIONS

## **e-mesh™ PowerStore™ Integrated 250/500**

Energy storage with a compact footprint



e-mesh™ PowerStore™ Integrated 250/500, is ABB's latest battery energy storage solution that helps ensure power reliability and availability, grid stability, and the integration of renewable energy enabled by advanced automation technology.

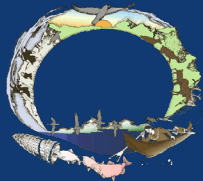
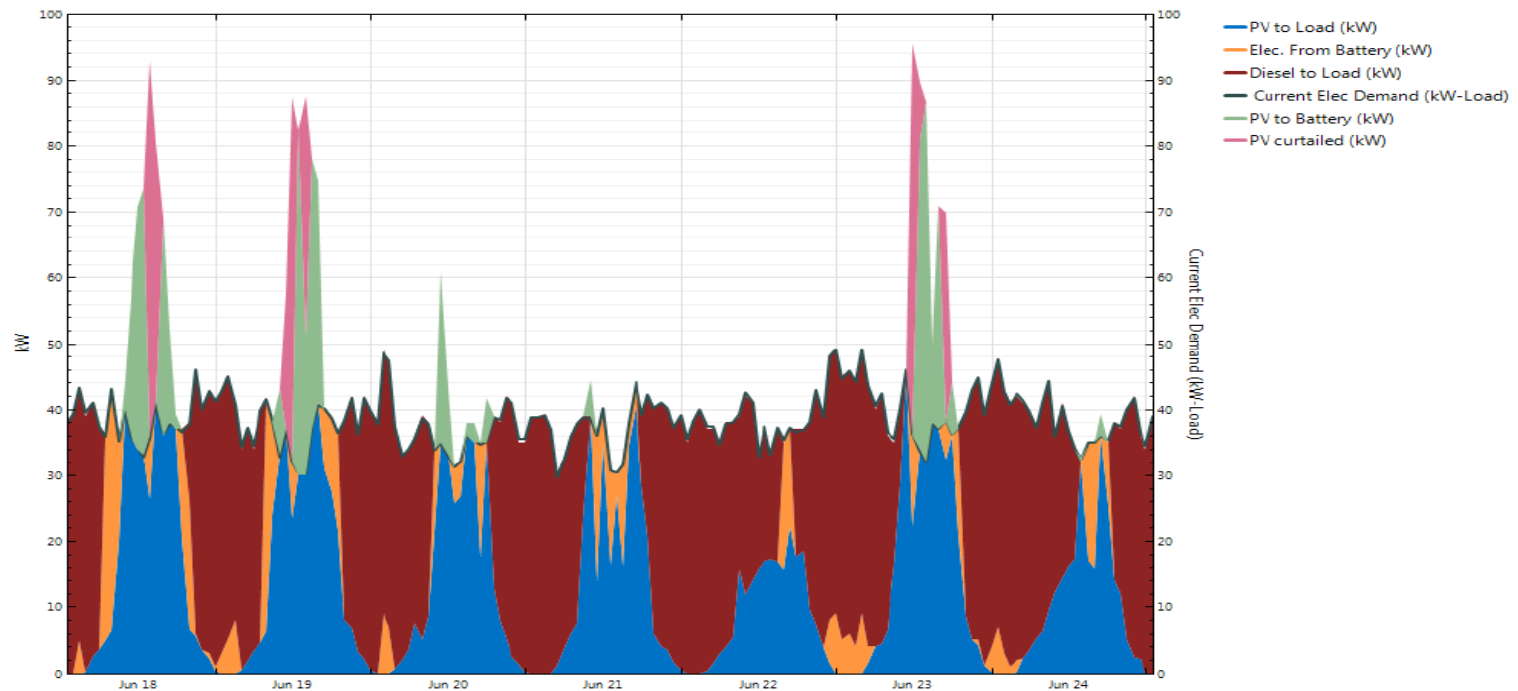


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# NREL Modeling in Hughes

## Dispatch – Nominal battery cost



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# Actual Data for Hughes

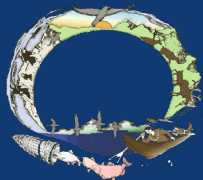


## Hughes 2022 Energy Summary (kWh)

Generation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Diesel 1	--	--	--	410	130	--	--	--	--	--	--	--	540
Diesel 2	57,310	48,000	48,210	35,560	28,190	24,510	22,060	23,410	29,200	21,820	--	--	338,270
Diesel 3	--	--	--	--	--	--	--	--	--	--	--	--	--
Diesel 4	--	--	--	--	3,540	2,450	1,330	4,780	1,990	21,780	--	--	35,870
<b>Total Diesel Generation</b>	<b>57,310</b>	<b>48,000</b>	<b>48,210</b>	<b>35,970</b>	<b>31,860</b>	<b>26,960</b>	<b>23,390</b>	<b>28,190</b>	<b>31,190</b>	<b>43,600</b>	--	--	<b>374,680</b>
<b>Total Solar Generation</b>	--	--	--	5,290	8,769	6,440	10,949	7,212	4,121	1,918	--	--	<b>44,699</b>
<b>Total Generation</b>	<b>57,310</b>	<b>48,000</b>	<b>48,210</b>	<b>41,260</b>	<b>40,629</b>	<b>33,400</b>	<b>34,339</b>	<b>35,402</b>	<b>35,311</b>	<b>45,518</b>	--	--	<b>419,379</b>

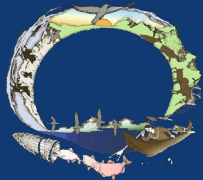
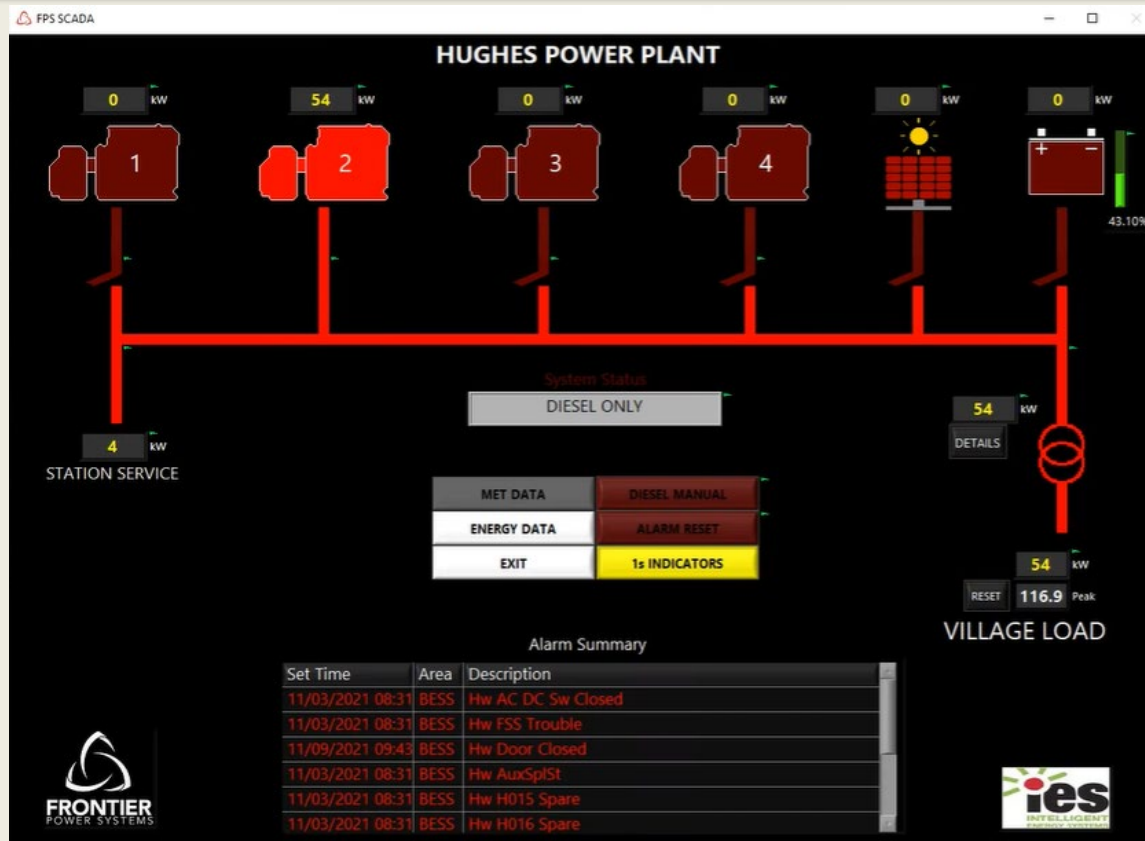
Consumption	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Station Service	5,559	5,072	3,902	3,167	2,809	3,812	2,934	2,626	2,469	2,476	--	--	34,826
Solar to Village	--	--	--	5,290	8,769	6,440	10,949	7,212	4,121	1,918	--	--	44,699
Total Village	57,310	48,000	48,210	41,260	40,629	33,400	34,339	35,402	35,311	45,518	--	--	419,379
<b>Total Consumption</b>	<b>57,310</b>	<b>48,000</b>	<b>48,210</b>	<b>41,260</b>	<b>40,629</b>	<b>33,400</b>	<b>34,339</b>	<b>35,402</b>	<b>35,311</b>	<b>45,518</b>	--	--	<b>419,379</b>

<b>%Diesel kWh Displaced by Solar</b>	--	--	--	<b>12.8%</b>	<b>21.6%</b>	<b>19.3%</b>	<b>31.9%</b>	<b>20.4%</b>	<b>11.7%</b>	<b>4.2%</b>	--	--	<b>10.7%</b>
---------------------------------------	----	----	----	--------------	--------------	--------------	--------------	--------------	--------------	-------------	----	----	--------------



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# Micro Grid Control Package



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# Delays = Budget

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Original Budget

All In Cost with DOE  
cost-share reduction

\$623k DOE

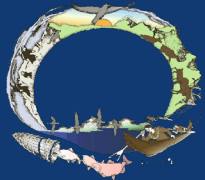
\$913k DOE

\$127k Hughes/TCC

\$314k Hughes/TCC

\$751k Total Project

\$1.2M Total Project



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# Why is DOE Funding so Important?

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## Hughes Village Light and Power FY18

Customers: 63

Annual kWh Sales: 443,942

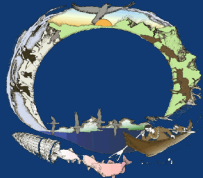
Expense/kWh (Fuel, parts, Staff) : \$.79/kWh (\$.55 Fuel \$.24 non Fuel)

10 year loan at 4% interest for this project:

Payments: \$11,370/mo x12 = \$136,332 - \$66k Fuel Savings = \$70,332

$\$70,332 / 443,942 \text{ kWh} = \$.16/\text{kWh}$

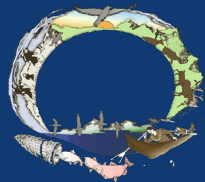
***New \$/kWh = \$.95/kWh = 20% cost increase***



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# Project Challenges

1. ~~Cost effective design and battery bank in a changing Battery Market~~
2. ~~Single Phase limitation in the community of Hughes~~
3. ~~Getting panels and battery bank out of the flood plain~~
4. ~~Implementation of Effective Micro-grid Control System~~
5. ~~Budget~~
6. ~~ABB: E-mesh Vendor~~
7. Taking advantage of PCE



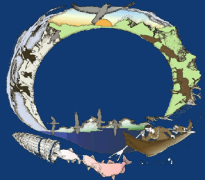
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# How Important is this?

**Word travels fast,  
success travels faster**

1. Kotzebue
2. Shungnak
3. Noatak
4. Galena
5. Huslia?



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# Ana Basee' (Thank you!) Dept. of Energy for your support!

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Thank you also: Intelligent Energy Systems, Frontier power Systems, Deerstone Consulting, Ed Dellamary the city of Hughes, AK

“Self Sufficiency is the greatest of All Wealth” - Epicurus

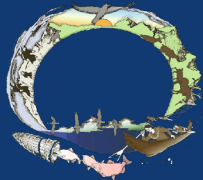
## Questions?

Dave Messier

Tanana Chiefs Conference

Infrastructure Division Director

[Dave.pm@tananachiefs.org](mailto:Dave.pm@tananachiefs.org)



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