

Status of City of Unalaska Wind Power Development and Integration Assessment Project

Presentation to City Council

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V3 Energy, LLC

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History of project

- Wind energy feasibility study of Naknek and Unalaska
 - Dames and Moore, 1999, for Alaska Division of Energy
 - No data collected
- **Phase I**, wind integration assessment
 - Northern Power Systems, 2005, draft report
 - No data collected
- RFP for **Phase II to IV**
 - Awarded to V3 Energy, LLC, Aug. 2017
- **Phase II**, develop data collection plan
 - Site options, integration, historical, environmental, and permitting reviews, and data collection plan
 - Report Aug. 2018

History, continued

- **Phase III**, implement data collection plan
 - Install meteorological (met) towers
 - Collect wind data
 - Wind Resource Assessment report, Feb. 2022
- **Phase IV**, pre-development plan
 - Analyze effects on powerhouse
 - Assess development paths
 - Economic analyses
 - In progress

Phase II Site Options

- Unalaska terrain complex and constrained
- Airspace restrictions
- Limited electrical distribution network
- Lower Pyramid Valley obvious candidate
- Hog Island alternate relatively large area
- Ballyhoo has higher elevation access, but very high modeled wind speeds, icing, steep switchback road, WWII National Historic Area

Met towers (guyed, tubular)

- Lower Pyramid Valley (near Veronica Lake), 60 meter (197 ft.), 10/2018 to 8/2021
- Hog Island, 60 meter (197 ft.), 8/2019 to 4/2021
- Icy Creek Reservoir, 34 meter (112 ft.), 10/2018 to 10/2019
- Bunker Hill summit, 10 meter (33 ft.), 10/2018 to 6/2020

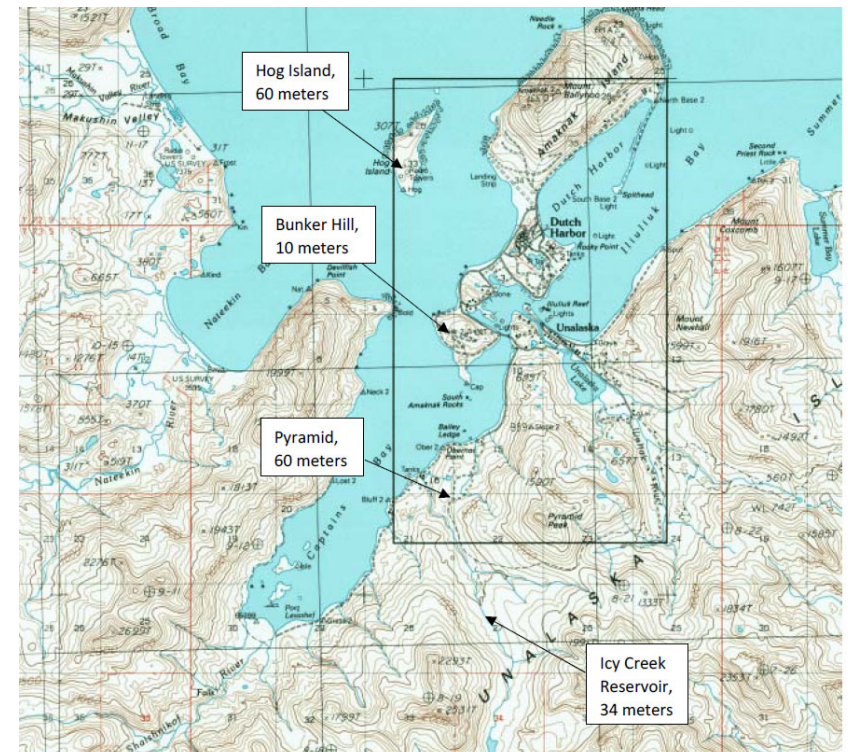
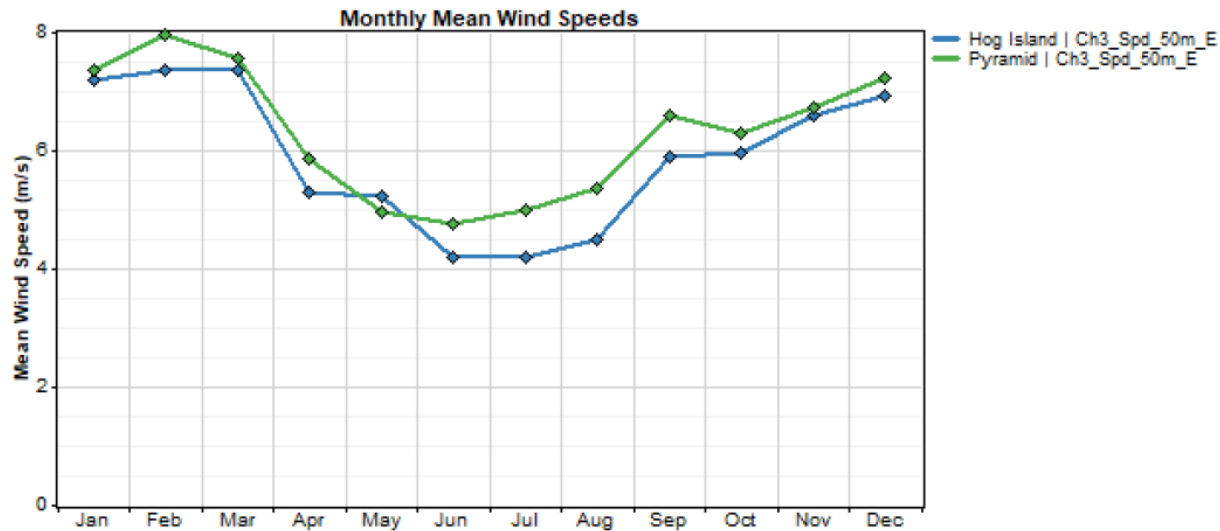




Figure 2: Pyramid 60-meter met tower (Andy Dietrich aerial photo)

Pyramid vs. Hog Island

- Pyramid Valley: 6.84 m/s (15.3 mph) mean speed at 60 m, wind power class 5 (of 7), 51.4 m/s (115 mph) max. gust
- Hog Island: 6.00 m/s mean wind speed at 60 m level, wind power class 3, 40.7 m/s (91 mph) gust, instrumentation problems



Pyramid wind summary

Data dates	10/16/2018 to 8/12/2021 (34 months)
Datalogger information	NRG Symphonie PRO, 26 channel, site no. 3550
Site coordinates	53.8496 North, 166.5625 West (WGS 84 datum)
Site elevation	103 meters (334 ft.)
Wind speed, mean annual, 60 m level	6.84 m/s corrected to Dutch Harbor Airport long-term weather station data; 6.39 m/s as measured
Wind power density, mean annual, 60 m	548 W/m ² when corrected to Dutch Harbor Airport long-term weather station data; 446 W/m ² as measured
Wind power class	5 (excellent), when corrected to Dutch Harbor Airport long-term weather station data) of 7 defined classifications; 4 (good) as measured
Maximum 10-min. avg wind speed	37.5 m/s (83.9 mph)
Maximum 3-sec. gust wind speed	51.4 m/s (115.0 mph)
Wind shear power law exponent	0.100 (low; 0.140 considered nominal)
Calm wind frequency (winds < 4 m/s)	Approx. 33%
Extreme wind probability (50-year period)	41.3 to 47.6 m/s
Turbulence intensity, 60 m level	0.120
IEC 61400-1 3 rd ed. classification	Class IIB

Alaska Energy Authority's Renewable Energy Fund (REF)

- Round 13 (2020) grant award (\$139K) to COU for wind power feasibility (signed 1/2022 due to appropriation delay)
- Remaining Phase III and IV tasks transferred to REF13 project
- Accomplished to date:
 - Site wind flow and power system modeling
 - Hired HDL 5/2022 to review WTP geotech studies for foundation design
 - Scope mod 6/2022 for pre-design to enable application for construction
 - Hired EPS 7/2022 to assess interconnection and powerplant integration
 - Hired STG 10/2022 to assess construction requirements and costs
 - Requested EWT turbine cost quote 9/2022

EWT DW58-1000

- Emergya Wind Technologies, The Netherlands
 - 58 m (190 ft.) rotor diameter, 1,000 kW capacity
 - Gearless/direct drive, synchronous generator, tubular tower
 - Tip heights of 250 ft./325 ft. (46 m/69 m hub hts.)
 - Designed for isolated grids (like Unalaska)
 - Survivability wind speed 59.5 m/s (133 mph)
 - Nine in rural Alaska (2 in Kotzebue, 2 in Nome, 2 in Delta Junction, 1 in Bethel, 1 in St. Mary's, 1 soon in Stebbins)
 - All are previous generation DW52-900 and DW54-900 models, (survivability of 59.5 and 52.5 m/s respectively)



EWT DW54-900 HH75 in Kotzebue

Possible Project

- One EWT 58-1000 wind turbine
 - COU land between WTP and Veronica Lake
 - Generate ~ 2,260 MWh/yr (approx. 4.8% of 2019-2022 electric load demand)
- Cost estimate
 - \$8.6M, AEA estimated cost for 1 MW wind
 - \$13.35M AEA estimated cost for 2 MW wind
 - Costs based on Alaska reference projects
 - Most are summer-only barge access on permafrost soils
 - Note lower cost/kW for 2+ turbines
- Working on Unalaska-specific price estimates and quotes

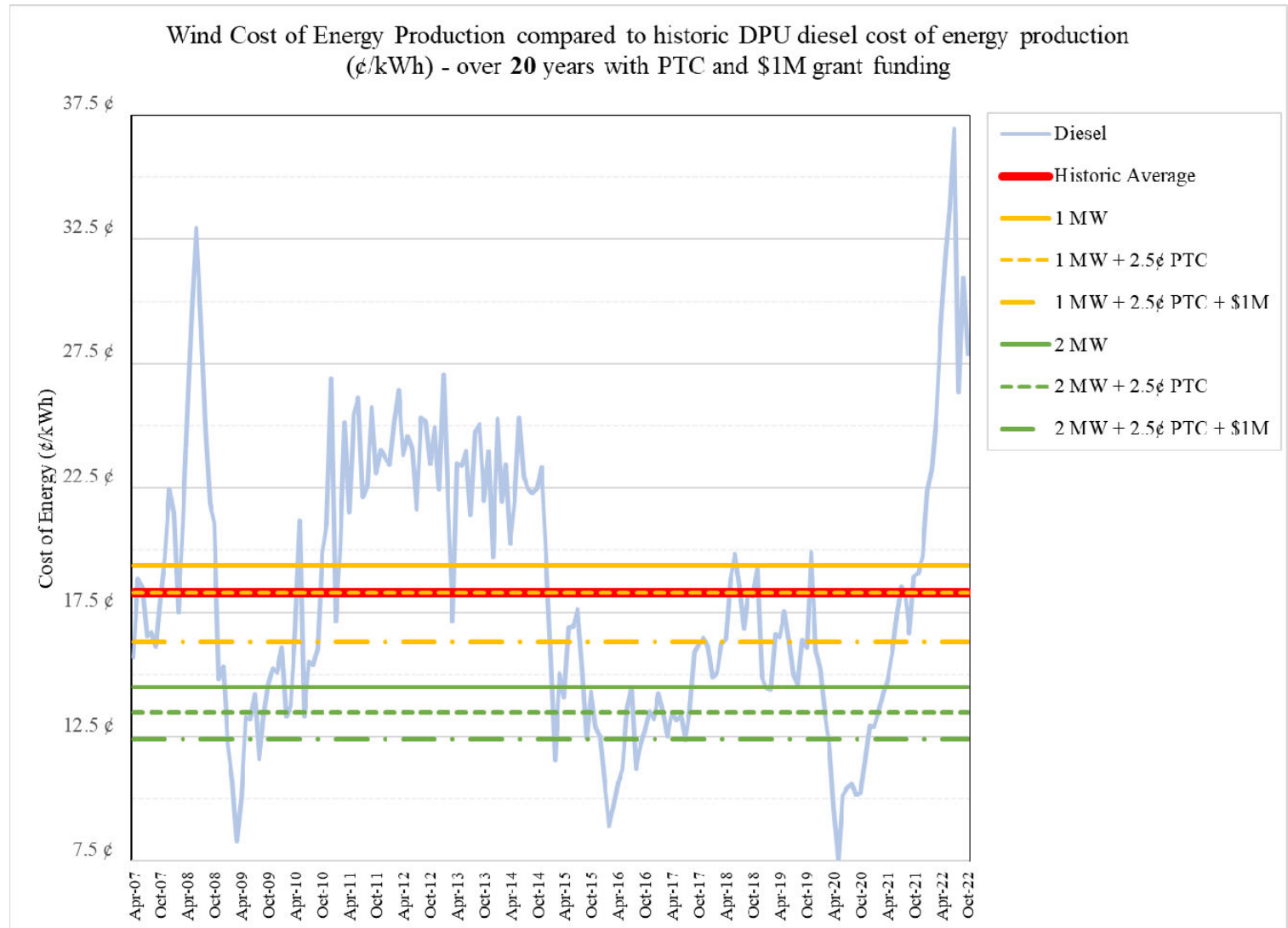
Funding Opportunities

- AEA Renewable Energy Fund Round 15
 - Applications due: 12/5/2022
 - AEA makes recommendations to legislature: 3/15/2023
 - Legislative approval and signed by governor: 6/30/2023
 - Award effective date: 7/1/2023
 - \$4M maximum award for design/construction project
- Inflation Reduction Act
 - 0.5¢-to-2.5¢/kWh production tax credit (PTC) for 10 years

Wind vs. Diesel Cost of Energy

Assumptions:

- 20-yr project life
- 2.5¢ Production Tax Credit (PTC)
- \$1M grant

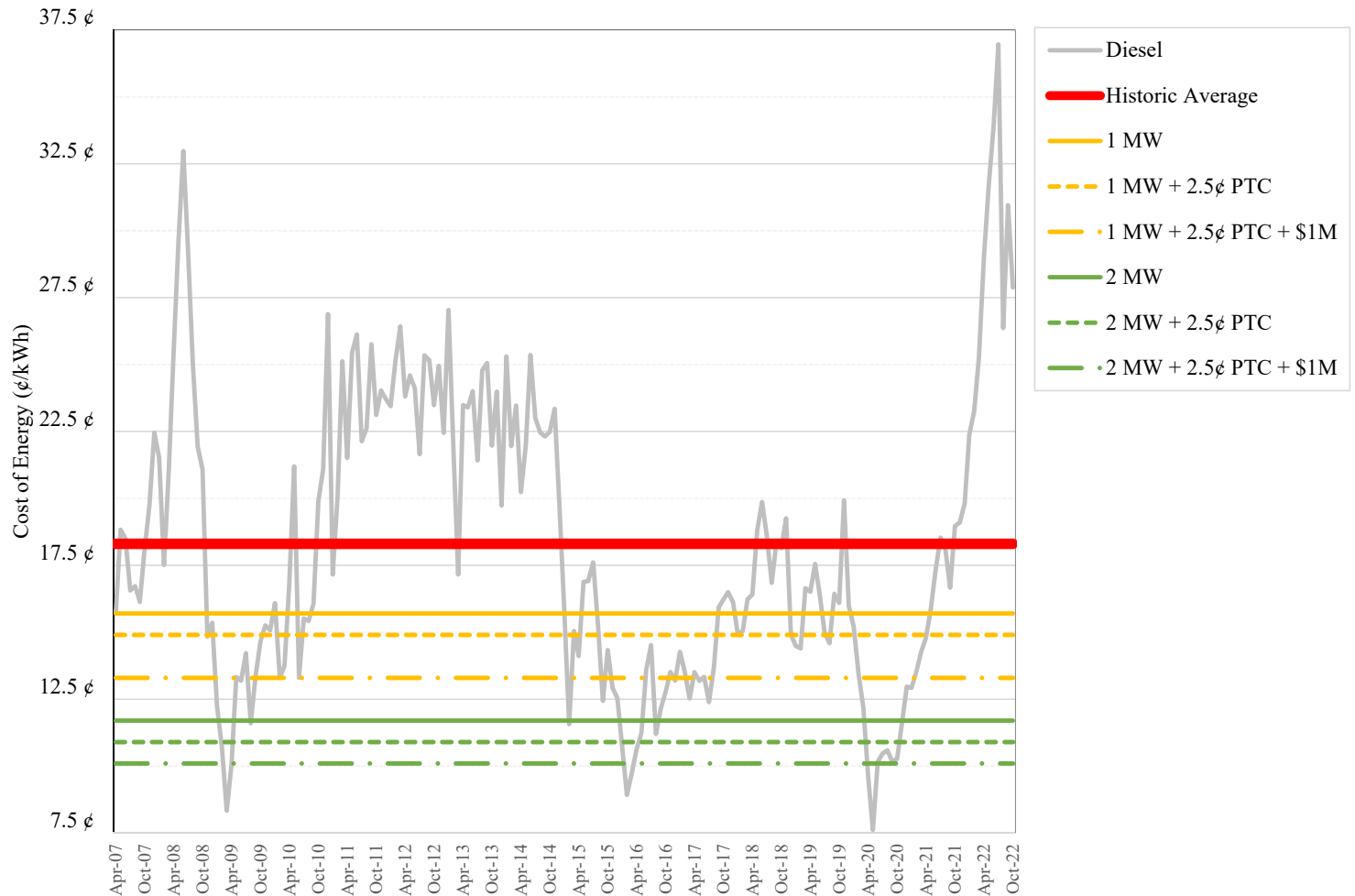


Wind vs. Diesel Cost of Energy

Assumptions:

- 25-yr project life
- 2.5¢ Production Tax Credit (PTC)
- \$1M grant

Wind Cost of Energy Production compared to historic DPU diesel cost of energy production (¢/kWh) - over 25 years with PTC and \$1M grant funding



Wind Project Cost Scenarios

Scenario	20 yr	Difference from Historic Average	25 yr	Difference from Historic Average	Captial Outlay (millions)
	¢/kWh		¢/kWh		
2007-2022 Avg DPU cost of energy production	18.3 ¢		18.3 ¢		
1 MW wind cost of energy	19.4 ¢	1.1 ¢	15.7 ¢	-2.6 ¢	\$ 8.6
1 MW + 2.5¢ PTC	18.3 ¢	0. ¢	14.9 ¢	-3.4 ¢	\$ 8.6
1 MW + 2.5¢ PTC + \$1M grant	16.3 ¢	-2. ¢	13.3 ¢	-5. ¢	\$ 7.6
1 MW + 2.5¢ PTC + \$2M grant	14.2 ¢	-4.1 ¢	11.6 ¢	-6.7 ¢	\$ 6.6
1 MW + 2.5¢ PTC + \$4M grant	10.1 ¢	-8.2 ¢	8.4 ¢	-9.9 ¢	\$ 4.6
2 MW wind cost of energy	14.5 ¢	-3.8 ¢	11.7 ¢	-6.6 ¢	\$ 13.3
2 MW + 2.5¢ PTC	13.5 ¢	-4.8 ¢	10.9 ¢	-7.4 ¢	\$ 13.3
2 MW + 2.5¢ PTC + \$1M grant	12.4 ¢	-5.9 ¢	10.1 ¢	-8.2 ¢	\$ 12.3
2 MW + 2.5¢ PTC + \$2M grant	11.4 ¢	-6.9 ¢	9.3 ¢	-9. ¢	\$ 11.3
2 MW + 2.5¢ PTC + \$4M grant	9.4 ¢	-8.9 ¢	7.6 ¢	-10.7 ¢	\$ 9.3