



2004 Wind Diesel Conference

St. Paul, Alaska Operational Experiences

September 2004

St. Paul Island, Alaska



Project Background

System: 500 kW standalone utility,
combined heat and power

Composition: Vestas V27 turbine, two
150kw Volvo diesel generators.

Configuration: High penetration/no
storage wind-diesel

Application: Providing electricity and space
heat to industrial/airport facility

Avg. Power Generation: 876,000 kWh per
year – 40% capacity factor



System Composition



Operational Data

Month	<u>Gross Kwh Generated</u>											
	Diesel Plant #1	Diesel Plant #2	Diesel Plant #3	Diesel Plant #4	Diesel Plant #5	Total Diesel Gen	Wind Turbine #1	Wind Turbine #2	Wind Turbine #3	Diesel & Wind	Fuel Consum	
January	1981	32413				34394	98569				132963	3167
February	0	36446				36446	85783				122229	2322
March	7673	54433				62106	38717				100823	4076
April	5916	44070				49986	56747				106733	4027
May	22315	27887				50202	56074				106276	3340
June	14321	38731				53052	22746				75798	3625
July	12985	45222				58207	24557				82764	3919
August	14937	41885				56822	23397				80219	4025
September	24640	25591				50231	49139				99370	3300
October	9956	12528				22484	97248				119732	1963
November	21034	7203				28237	97435				125672	2057
December						0					0	
Total	135758	366409				502167	650412				1152579	35821

Operational Data

<u>Facility Load KwH</u>				<u>Net KwH</u>	<u>Gross Efficiency</u>		<u>Line Loss/Gain</u>		
Thermal Tank	Station Service	Facility Usage	Total T, S & F	KwH Sold	Diesel Eff Gen KwH/GI	System Eff Gen KwH/GI	KwH	%	% Production by Wind
63195	0	56349	119544	0	10.86	41.98	13419	0.101	74%
55642	0	54555	110197	0	15.70	52.64	12032	0.098	70%
34660	0	56505	91165	0	15.24	24.74	9658	0.096	38%
42838	0	53416	96254	0	12.41	26.50	10479	0.098	53%
44677	0	51378	96055	0	15.03	31.82	10221	0.096	53%
27086	0	40795	67881	0	14.64	20.91	7917	0.104	30%
31656	0	43987	75643	0	14.85	21.12	7121	0.086	30%
31115	0	42159	73274	0	14.12	19.93	6945	0.087	29%
45201	0	43996	89197	0	15.22	30.11	10173	0.102	49%
68047	0	38958	107005	0	11.45	60.99	12727	0.106	81%
70716	0	43291	114007	0	13.73	61.09	11665	0.093	78%
	0		0	0	#DIV/0!	#DIV/0!	0	#DIV/0!	#DIV/0!
514833	0	525389	1040222	0	14.02	32.18	112357	0.097	56%

Operational Data

Month	<u>System Outages</u>							
	Date	Time	Outage Cat.	No. Outage Hours	Cause	No. Consumers Affected	Return Service Date	Returned Time
January	No Outages							
February	No Outages							
March	No Outages							
April	04/09/04	1:35pm	NG	10min	Paul had accidently left a cooling system	All	04/09/04	1:45pm
May	05/06/04	2:30pm	NG	1 min	(D1) Paul reported a 1 minute shut down	All	05/06/04	2:31pm
June	No outages							
July	No Outages							
August	No Outages							
September	No Outages							
October	10/17/04	6:15am	WNG	2 hrs	(D2) Syn-check relay fault/high winds-gusts	all	10/17/04	8:15am
	10/18/04	7:30am	NG	.75 hrs	(D2) Starter relay failure	all	10/18/04	8:20am
	10/25/04	2:30am	NG	6.1 hrs	(D2) DirPowNeg Hi-High Temp	all	10/25/04	8:10am
November	11/01/04	11:05am	WNG	2 min	Very high gusty winds (D2) Dir-PowPos Hi	all	11/01/04	11:07 AM
December								
Total	0.00				0			

Outage Categories

- | | | | |
|---------|--|-----------|---|
| (1) SG | Scheduled - Generation | (4) ST&D | Scheduled - Transmission & Distribution |
| (2) NG | Non-Scheduled - Generation | (5) NT&D | Non-Scheduled - Transmission & Distrib |
| (3) WNG | Weather Related Non-Scheduled - Generation | (6) WNT&D | Weather Related Non-Scheduled - Transi |

Operational Experiences

Wind-generated electricity production

- reduced diesel generator fuel consumption by 3,346 gallons/yr
- reduced fuel for space heating consumption by 8,940 gallons/yr

Wind turbine gearbox failures caused by design flaw downtime during peak winter wind resource.

- failure resolved by manufacturer redesign resulting in dramatic increase in wind kWh production

99.9% availability in 2004. Capacity factor in January 2004 was 60.49 %





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