Kokhanok Wind-Diesel System Update

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Marsh Creek Energy Systems

AK Native Village Energy Development Workshop

April 29, 2014

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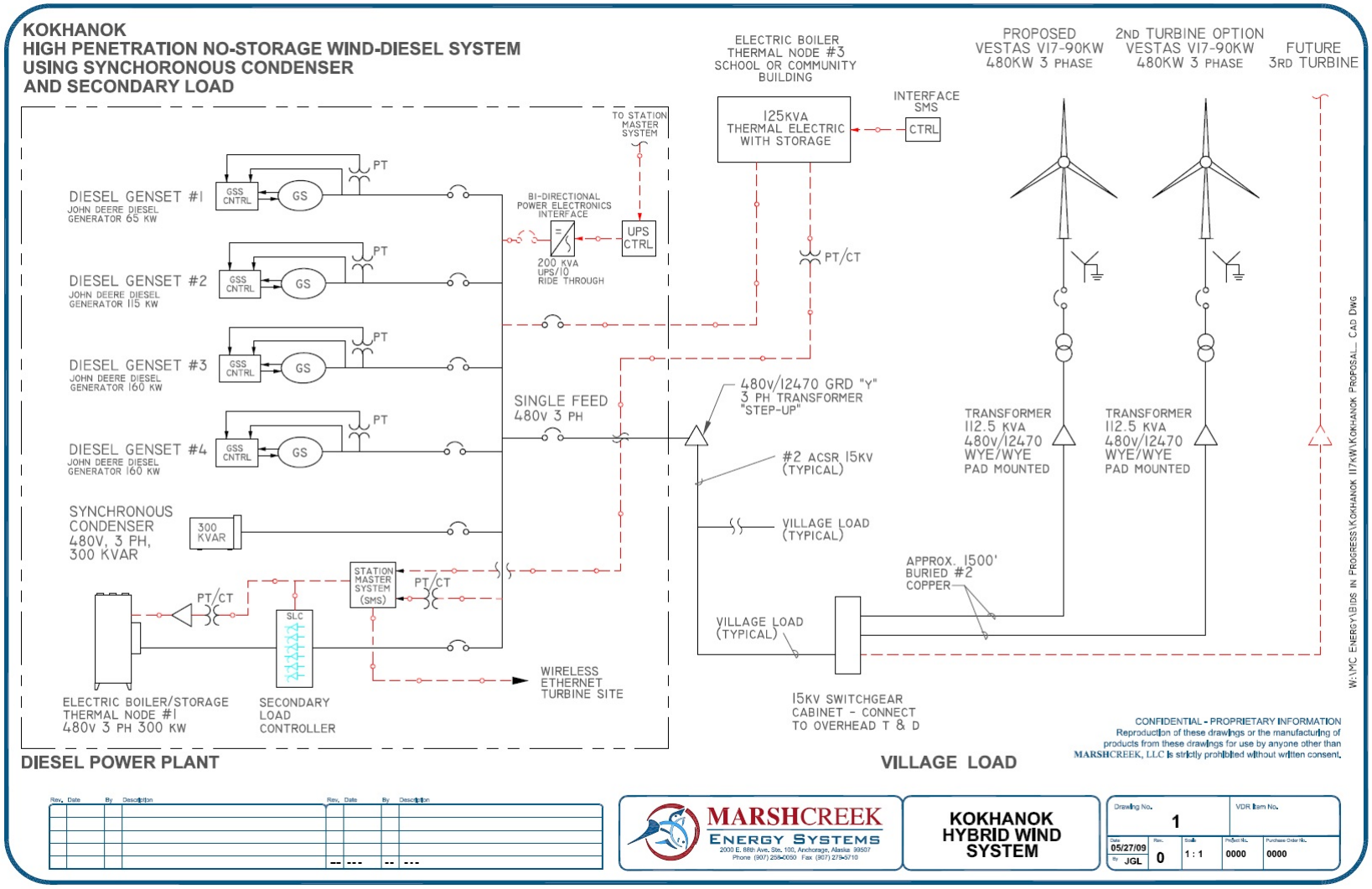
Kokhanok Electric Utility

System	470 kW of diesel power 2 refurbished Vestas wind turbines rated at 90 kW each
Power Generation	459,251 kWh in 2013 (17% wind – down from 30% 2012)
Peak Demand	106 kW
Population Served	170

System Overview



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System Overview

- Grid forming inverter
- 336 kWh nominal battery storage
- Synchronous condenser
- Thermal electric heat recovery system and secondary load control
- Two (2) Vestas V-17 turbines 90 kW each
- Four (4) Diesel Gen-sets
  - #1 - 65 kW
  - #2- 115 kW
  - #3 – 160 kW
  - #4 – 160 kW

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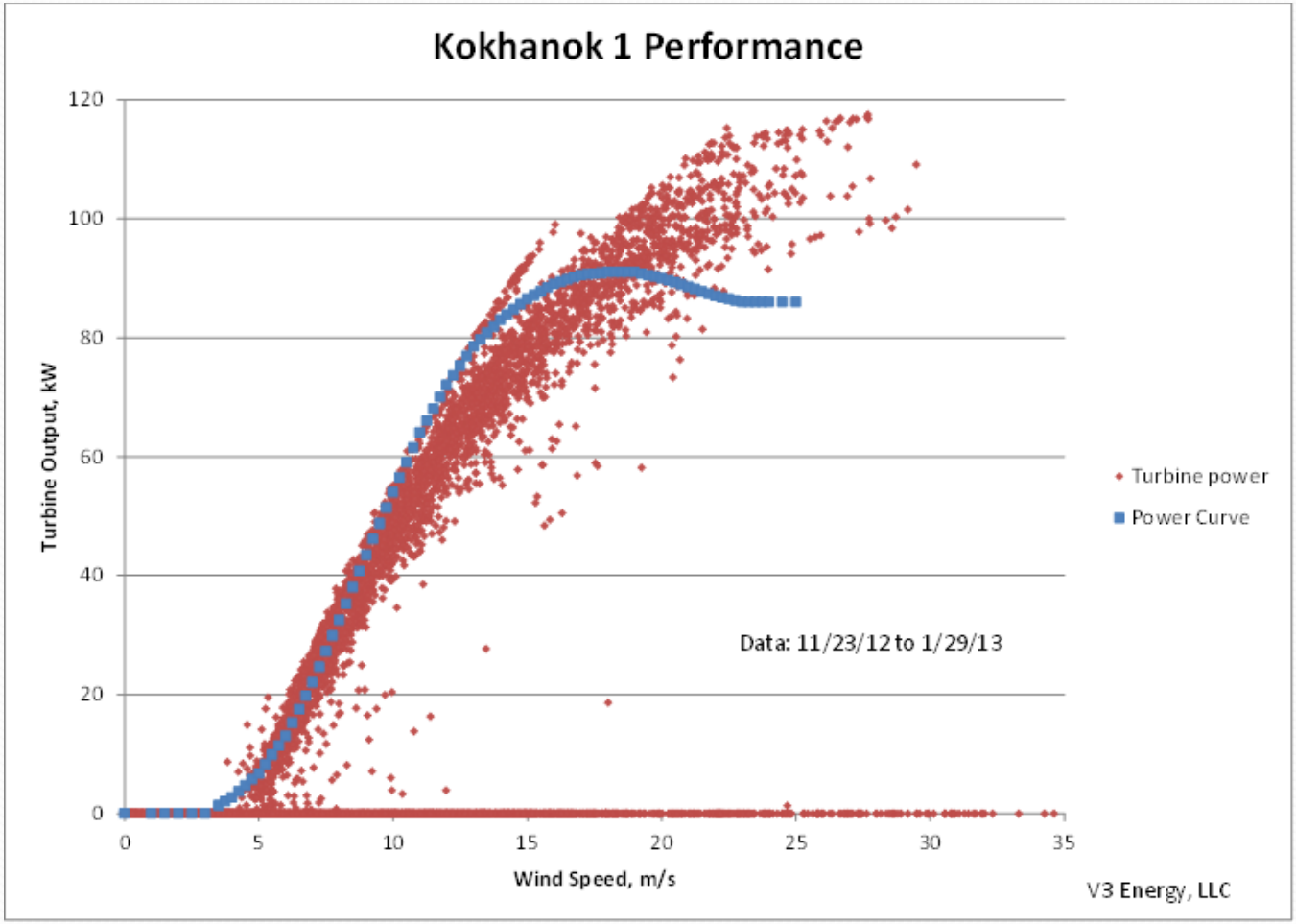
Production Data – Turbine #1



Source: Douglas Vaught, P.E. **-** V3 Energy, LLC

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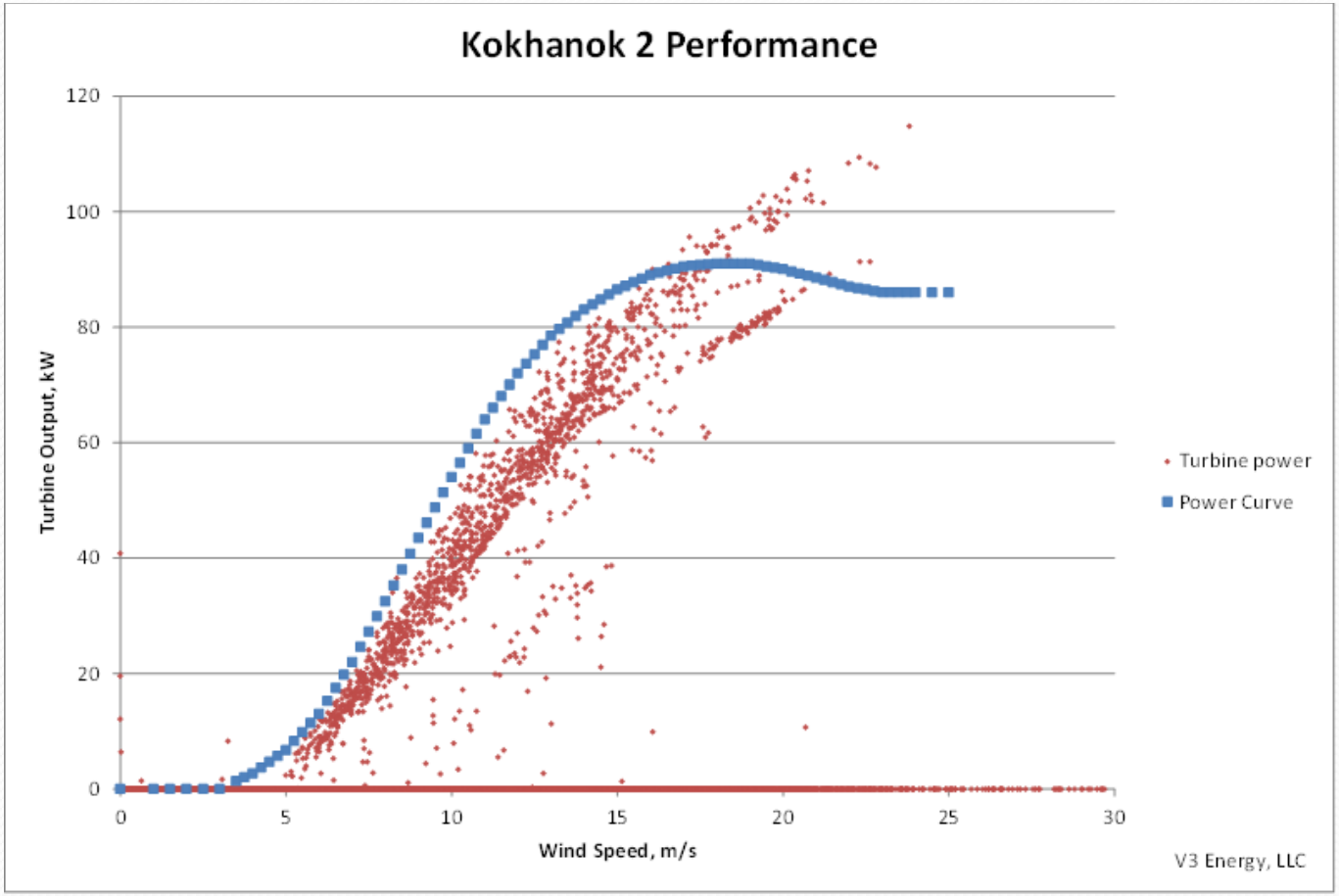
Production Data – Turbine #2



Source: Douglas Vaught, P.E. **-** V3 Energy, LLC

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Where are we?

- **2014 Wind Turbine Generator Production**
  - WTG 1: 0 kWhs WTG 2: 0 kWhs
- **Annual Wind Farm Energy Production**
  - 2011: 66,449 kWhs 2012: 150,396 kWhs 2013: 78,854 kWhs
- **School Heating Fuel Use Comparisons for Pre-Wind vs. Post Wind**
  - **2010 6,577 gallons 2012 6,595 gallons**
  - **2011 5,451 gallons 2013 3,784 gallons**
- **System Efficiency (kWhs produced per gallon of diesel burned)**
  - January 2010 12.4 kWh/gallon *3,845 gallons to produce 47,734 kWhs*
  - January 2013 18.6 kWh/gallon *3,017 gallons to produce 56,006 kWhs*
  - January 2014 11.33 kWh/gallon *3,532 gallons to produce 40,019 kWhs*

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Path Forward

- O&M Phase with the community – year 4 of 6 year agreement
  - Highly skilled local diesel technician now on board who is willing to climb and do WTG maintenance.
- Wind Farm curtailed since October and shut down since January due to lube oil contamination in coolant loop at the diesel plant.
  - Wind-Diesel Tech from Marsh Creek scheduled for site visit to put wind turbines back on line – as soon as the local diesel tech gets certified to safely climb the tower. Next class scheduled for the last week of May.
- Additional O&M Costs in 2013 requires a customer rate increase. The utility is awaiting a new PCE rate, based on 2013 costs, to implement.
- Final phase of high penetration system, the battery inverter, will be installed summer 2014. At that point the system will be able to run "diesels off" - with a trained local wind-diesel tech to watch over it.

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Questions?

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