

# WINDSYSTEMS

Wind Energy Systems for the World

**Alaska Harnesses Arctic Wind**  
TVA reports average 98% availability

**Head of the Class at  
Cassop Primary in  
Durham, England**

**Extreme Power**  
to make ice in Sahara Desert  
and pump oil in Siberia

**Fuel Savings:**  
Five year payback



Atlantic Orient Corporation designs and builds state-of-the-art wind turbine generators. Our turbines are reliable, durable, cost-effective and environmentally friendly.

### THE COMPANY

Atlantic Orient Corporation (AOC), headquartered in Norwich, Vermont, designs and manufactures a mid-sized advanced wind turbine system for integration with diesel generators and installation in rural and remote regions of the world. The specific purpose of the AOC wind turbine energy system is to dramatically reduce the amount of very expensive diesel fuel consumed in these remote areas and to offset the retail price of electricity. In many applications the fuel savings alone will provide a payback within five years.

### PROVEN DESIGN

Since 1986, AOC has designed and built state-of-the-art wind turbine generators. Design innovations, exhaustive testing, and advanced technology have led to a wind turbine generator with high availability, even in extreme Arctic or desert conditions. Our turbine's performance consistently meets or exceeds design specifications and requires low maintenance throughout its expected operating life.

### EXPERIENCE

Atlantic Orient Corporation has extensive utility systems experience to efficiently integrate wind energy into your system. Our engineering team is composed of individual talents yet one goal: to design the highest value wind turbine generators for your application. Our engineering capabilities are widely recognized and respected in the wind energy industry worldwide.

### RELIABLE

Our goal is robust simplicity and failsafe reliability with minimal maintenance requirements over a thirty year design life in extreme environmental conditions. Our design process utilizes peer review, international standards, component qualification testing and field testing. Independent analysis and testing at the National Renewable Energy Laboratory (NREL), the Netherlands Energy Research Foundation ECN, RISO Laboratory in Denmark,

## KOTZEBUE, ALASKA, USA

**Purpose:** Generate lower cost electricity for community of 3,500 residents, north of the Arctic Circle, while reducing environmental risk from transport, storage and burning of diesel fuel.

**Description:** Three AOC 15/50 wind turbines were installed in 1997 with seven additional turbines installed in the spring of 1999. Each turbine is estimated to displace enough diesel fuel to power 17 to 29 homes, or about 5 percent of the current electrical demand.

**Results:** U.S. DOE-EPRI Wind Turbine Verification Program reported in the April 1999 TVP News Bulletin: "Over the past six months, the three initial turbines have average more than 98% availability. During the February reporting period, the project generated 56 MWh, which equates to an impressive 38% capacity factor assuming a sustained peak power rating of 66 KWh per turbine. Turbine output has been higher than projected by the power curve in the extremely cold temperatures - and increased air density - of Kotzebue winters."



Ten AOC 15/50 Wind Turbine Generators in Kotzebue, Alaska Reduce Diesel Fuel Consumption in Remote Village

### The AOC 15/50 Wind Turbine Generator

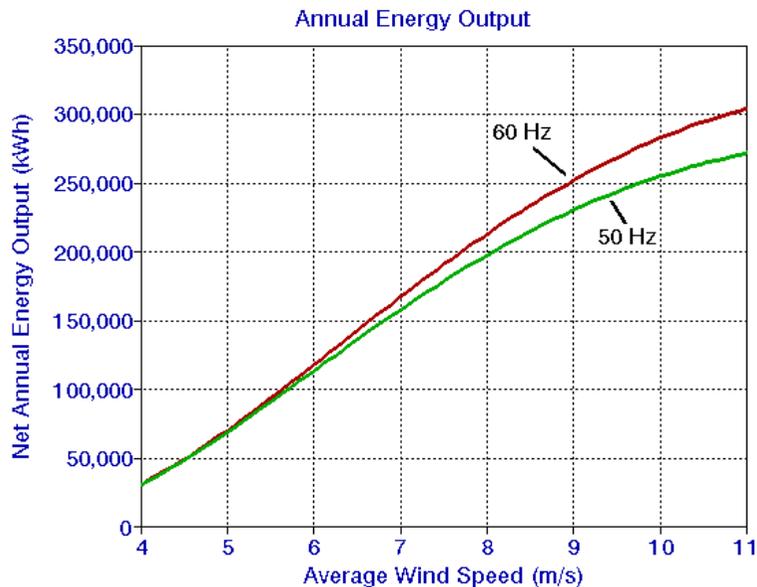
The AOC 15/50 wind turbine consists of a 15 meter rotor which produces 50 kW at an 11.3 m/s wind speed (60 Hz model). The turbine was developed in conjunction with the U.S. Department of Energy and the National Renewable Energy Laboratory (NREL) under their Advanced Wind Turbine (AWT) Program. The goal of this cost shared program was to produce economic wind generated electricity in a moderate average wind resource. This was achieved with simplicity in design, high availability and failsafe reliability.

Induction Generator    Integrated Gearbox    Single Piece Cast Rotor Hub



Parking Brake    Cast Tower Top    Yaw Bearing    Rotary Transformer

# Power Output



**NOTE:**

Power curves show typical power available at the controller based on calculated data. Annual energy is calculated using power curves and a Rayleigh wind speed distribution. Energy production may be greater or lesser dependent upon actual wind resources and site conditions, and will vary with wind turbine maintenance, altitude, temperature, topography and the proximity to other structures including wind turbines.

## SIBERIA, RUSSIA

Purpose: Generate power to pump oil in an extreme cold environment.

Description: The AOC wind-diesel system has five (50 Hz) wind turbines which automatically start and connect to the system grid when the wind speed exceeds approximately 4.6 m/s (10.2 mph) with a rated output of 50 kW at 12 m/s (26.9 mph). The wind turbines reduce the load on two diesel generators and the fuel consumed. A central controller uses a PLC to enable complete monitoring of wind turbine status and remote control of the wind turbines and diesel generators by the operator. The central controller stores operational events such as operating hours, faults, maximum and minimum power levels, and kWh's produced by each wind turbine and diesel generator.



## TINIGUIR, MOROCCO

Purpose: Power large greenhouse and residential complex in the western Sahara Desert.

Description: A team of experienced utility, mechanical, and production engineers from Atlantic Orient Corporation designed, built, and installed the wind-diesel system and custom grid for the greenhouse complex.



Using one AOC 15/50 (50Hz), two 50 kW diesel generators, and 1.5 miles of 2400 volt overhead power line, the system powers a 12 ton per day ice maker, irrigation pumping, crop processing, and lighting and refrigeration for the housing complex.

### Wind/Diesel

In many parts of the world diesel generators are used to power remote communities or industrial sites. With the rising cost of fuel and its transportation, as well as the environmental risk involved in transporting and burning fossil fuels, many communities and companies are using wind generators to reduce their reliance on diesel.

### Grid Intertie

The AOC 15/50 is ideal for grid-intertie applications. The AOC 15/50 requires a utility intertie with the following characteristics:

- 50 kW (or greater) AC power
- 50 or 60 Hz power frequency
- 3-phase power

### Net Billing

Many governments now allow for Net Billing, which means that power produced by wind turbines "turns back" the electricity meter. The wind generator is "tied in" to the power grid, and excess power produced by the wind generator is sold to the utility.

## LANARKSHIRE, SCOTLAND & CASSOP, ENGLAND



Purpose: Supply renewable, pollution free electricity and serve as an educational resource.

Description: After success with an energy-displacement wind turbine installed in 1998 at the Carmichael Estate in Lanarkshire, Scotland, a similar machine was installed to serve Cassop Primary School in England. The AOC 15/50 installed at the school is a 50 kW, 415v, 50 Hz wind turbine generator.

Results: The AOC 15/50 wind turbine at the estate offsets the electricity demand for a sawmill, visitor center, tourist accommodations, restaurant and private houses. At the school, the turbine generator is expected to produce 145,000 kWh per year in an average wind speed of 6.7 m/s (15 mph). The school use averages 40,000 kWh annually. Excess electricity will be sold to the local utility.



Prime Minister Tony Blair and students "switched on" the AOC 15/50 WTG at Cassop Primary School.

## BURLINGTON, VT, USA

Purpose: Offset retail cost of energy in industrial application.

Description: Dynapower Corporation, a manufacturer of standard and custom power electronics, partnered with Atlantic Orient Corporation to operate an AOC 15/50 wind turbine at its corporate headquarters in South Burlington, Vermont. The facility serves as a site for Atlantic Orient to prove consistent cold weather performance. The wind turbine helps Dynapower gain

an understanding of wind and power conversion systems while producing electricity for the factory.



As noted in the September 1998 issue of *Windletter*,

"Dynapower is using the AOC turbine to explore peak load-shaving opportunities by experimenting with different wind power conversion and energy

storage techniques." Laura Williams, Dynapower's marketing manager, said the company sees windpower as a "unique opportunity for us to play a part in the development and advancement of renewable energy as a resource for all power consumers."



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