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AN INVESTIGATION INTO THE FEASIBILITY OF
WIND AS AN ALTERNATE ENERGY RESOURCE AT
SELECTED NORTH GEORGIA SITES

Dorothy L. Brock, Ed.D.
Associate Professor of Biology
North Georgia College
Dahlonega, GA 30597

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An Investigation into the Feasibility of Wind as an Alternate Energy Resource at Selected North Georgia Sites

Dorothy L. Brock, Ed.D., Associate Professor of Biology, North Georgia College

ABSTRACT

Anemometers were placed at four select sites in North Georgia during the period July, 1980, to June, 1982. Regular wind speed readings were taken using accumulating recorders and average daily wind speeds calculated for each location. Three wind speed categories were determined: A) average below 7 mph, B) average between 7 and 25 mph, C) average above 25 mph. One site was abandoned after seven months due to lack of expected wind; another site was closed after 4.5 months due to continuing excessive and damaging winds. Two sites were determined, after 12 to 20 months of data collecting respectively, to have sufficient wind resources in a usable time pattern to merit further investigation. This study was funded through the Appropriate Energy Technology Small Grants Program of the US Department of Energy, Southeastern Region.

OBJECTIVES

This study originated in 1979 with the objectives of determining 1) the actual degree and pattern of wind energy available on selected sites in North Georgia, 2) the sites most promising in this respect, and 3) the compatibility between this information and the requirements for a wind energy conversion station.

In an effort to maximize the second objective, the original plan to survey farm sites in Lumpkin County was modified to include a variety of four locations, ranging from one farm on a northwest ridge to the highest and most exposed site available across North Georgia under the limitations of this study.

PROCEDURES

During the spring and summer of 1980, representatives from DOE and DOE-related offices in Atlanta visited the Dahlonega area and gave input regarding specific locations for wind study sites in Northeast Georgia. Dr. C. G. Justus, Climatologist and Professor at Georgia Institute of Technology, was especially helpful, accompanying these groups and returning alone for an all-day trip across North Georgia with this investigator to inspect prospective sites.

As a result of recommendations from these persons and strongly influenced by Dr. Justus' advice, this investigator designated the following four study sites for wind speed data collection:

- 1) A Lumpkin County farm with a northwest ridge, typical of NE Georgia farm terrain, elevation: 1690 ft.
- 2) Crown Mountain, elevation: 1730 ft., an open elevation within the city limits of Dahlonega, just west of Hwy. 60 S, in a developing suburb with a hospital, college, and forest service headquarters nearby.

- 3) Brasstown Bald, open elevation of 4784 Ft., highest point in Georgia, east of Blairsville off Hwys 180 and 66, at the Union and Towns County line, only development being a state park in the Chattahoochee National Forest.
- 4) Fort Mountain, open elevation of 2835 ft., in Fort Mountain State Park at the site of a forest service lookout tower and WCLP-TV transmitting station, in East Murray County between Chatsworth and Ellijay, off Hwy. 76.

Following the advice of Dr. Justus and information gained from A Siting Handbook for Small Energy Conversion Systems (Wegley, 1978), subject to constraints of budget and local site circumstances, the investigator, with assistance from other members of the North Georgia College Biology Department and college maintenance personnel, installed anemometers and data accumulators at the study sites according to the following specifics:

- 1) Lumpkin County farm: 30 ft. mast at 1690 fts. elevation on NW facing ridge
- 2) Crown Mountain: 8 ft. mast atop a 60 ft. tower at 1730 ft. elevation, open exposure
- 3) Brasstown Bald: 12 ft. mast atop a 80 ft. tower at 4784 ft. elevation, open exposure
- 4) Fort Mountain: 10 ft. mast extended NNW from tower at 85 ft., 2835 ft. elevation with NW to SE exposure

Personnel at the Lumpkin County and Blairsville stations of the Georgia Forestry Commission, Brasstown Bald State Park, WCLP-TV transmitting station and US Forest Service Fort Mountain lookout tower were all very cooperative and helpful with these installations.

The equipment installed was as follows:

- 1) Anemometer head, Model A75-104, manufactured by Maximum, Inc., marketed by Natural Power, Inc., New Boston, NH.
- 2) Wind data accumulator, Model A22, using two lithium D cells, also marketed by Natural Power, Inc.

The limitations of this study result from the above equipment supplied by a state office affiliated with DOE. The anemometer heads lacked durability essential for a valid study in the exposed areas studied, showing questionable readings with less than one year of use, following a period of high winds. One anemometer was actually destroyed. Three of the four had to be rebuilt due to wear of internal parts. The investigator initially requested graphic recorders which would give minute by minute patterns of wind speeds ~~over~~ for a study period, this being relevant to the assessment of the potential of a site for wind energy conversion. Instead, accumulators were supplied which recorded accumulated windspeed over time, to be divided by number of minutes in a study period to yield an average. Even if the station were manned and read hourly, only an average windspeed would be learned with no details regarding peaks, gusts, dips, lulls.

Data were collected at the Lumpkin County farm site twice daily from June to December, 1980. The recorded windspeeds at this site were so low that this station was dismantled when the instruments were needed at another more promising station in midDecember.

Data were collected at Crown Mountain from September, 1980, to June, 1982. Readings were taken daily when possible but at least on alternate days.

Data were collected at Brasstown Bald from July to December, 1980, when the anemometer was destroyed by gale-force winds not uncommon at that site. This incident followed suspect readings attributed to anemometer damage from continued high winds. Readings were taken daily at this site on a regular basis up to the loss of the instrument. Plans to install a second anemometer and requests for a more weather-worthy instrument were vetoed by Atlanta-based DOE personnel.

Data were collected twice daily at Fort Mountain from October 1980, to September, 1981. Since the anemometer on this site had to be replaced and rebuilt twice, when suspect readings began in September, 1981, this station was dismantled rather than supplied with a third instrument within one year!

RESULTS AND DISCUSSION

Results of this study are reported and analyzed in terms of A) winds averaging less than 7 mph (will not generate power with present-day technology), B) winds averaging 7 to 25 mph (range of constructive windspeed), and C) winds averaging above 25 mph (entering the destructive range depending upon equipment and wind patterns, i. e., gusts).

Data from the Lumpkin County farm site tabulated as follows:

<u>DATE</u>	Days: <u>< 7 mph</u>	<u>7-25 mph</u>	<u>> 25 mph</u>	<u>down*</u>
June (1980)	15	0	0	16
July	28	3	0	0
August	30	1	0	0
September	29	1	0	0
October	27	4	0	0
November	21	9	0	0
December	10	4	0	17

*equipment problems

As mentioned above, this site, totally disappointing, was dismantled when another site more promising suffered equipment problems. The anemometer and accumulator were moved to substitute for equipment down for repairs and this site was never reconstructed.

Data from the Crown Mountain site tabulated as follows:

<u>DATE</u>	Days: <u>< 7 mph</u>	<u>7-25 Mph</u>	<u>> 25 mph</u>	<u>down*</u>
September (1980)	0	3	0	27
October	18	13	0	0
November	8	22	0	0
December	10	21	0	0
January (1981)	5	19	0	7
February	9	12	0	7
March	3	28	0	0
April	7	23	0	0
May	15	12	0	4
June	16	14	0	0
July	24	7	0	0
August	20	0	0	11
September	27	3	0	0
October	24	7	0	0
November	27	3	0	0
December	12	13	0	6
January (1982)	7	8	0	18
February	12	14	0	2
March	6	25	0	0
April	9	21	0	0
May	6	25	0	0

*equipment problems

Data from the Brasstown Bald tabulated as follows:

<u>DATE</u>	Days: <u>< 7 mph</u>	<u>7-25 mph</u>	<u>> 25 mph</u>	<u>down*</u>
July (1980)	3	0	0	28
August	12	19	0	0
September	7	21	0	2
October	0	28	3	0
November	1	3	0	26
December	5	2	1	23

*equipment down

A note was received with the last report from this site shortly after 8 December 1980, from Richard Hood, Georgia Forestry Commission, Blairsville: "Sorry to inform you, but the cups have blown off the anemometer head. You need one that will stand high winds for a long period of time."

DOE contact persons in the Atlanta office vetoed any plan to purchase a better quality anemometer for this site, approved the purchase of an identical instrument to replace the one destroyed but vetoed placing it in jeopardy at the Brasstown Bald site. This study site was thusly discontinued.

Data from the Fort Mountain site tabulated as follows:

<u>DATE</u>	Days: <u>< 7 mph</u>	<u>7-25 mph</u>	<u>> 25 mph</u>	<u>down*</u>
October (1980)	2	26	0	3
November	0	27	3	0
December	0	30	1	0
January (1981)	1	30	0	0
February	0	25	3	0
March	0	29	2	0
April	0	29	1	0
May	1	30	0	0
June	4	23	0	0
July	3	28	0	0
August	10	21	0	0
September	2	4	0	24

*equipment down

IN SUMMARY: CONCLUSIONS AND RECOMMENDATIONS

The Lumpkin County farm site proved to be an unlikely site for a SWECS ("small wind energy conversion system"). However, this is not to say farms in Lumpkin County do not have this potential. One study site does not represent fairly an entire county nor certainly the northern quarter of the state. In order to make a definitive statement regarding availability of wind energy for power generation on North Georgia farm sites, one would need to return to the original proposal of this investigation, to set up study sites on as many farms as possible or feasible. This original plan was altered as described above.

The Crown Mountain site revealed 283 days out of 558 over a 20-month period with average wind speeds of 7 to 25 mph. These data were collected at a height of 68 feet above the ground. Studies reveal wind speeds increase significantly from 100 to 1000 feet above the ground. A higher installation would obviously reveal more promising results. Also, this site is in a developing area with homes, businesses, a hospital, and a school that could tap a local alternate energy resource profitably.

The Brasstown Bald site, being the highest point in the state, is the location expected to demonstrate maximum wind resources. Maximum is not always optimum, however. Of the 184 days in the abbreviated study period, there were 28 days of less than 7 mph average wind speed and 73 days of 7 to 25 mph average wind speed but 4 days of average wind speed above 25 mph and 79 days "down" due to equipment problems. Heavier duty instruments, raising the point of potential damage from 25 mph, would give a more accurate picture of the potential of this site for SWECS. Advanced technology will no doubt provide wind machines capable of surviving and making use of high winds and gusts. However, also to be considered is the fact that Brasstown Bald is remote and any installation here would require long distance transportation of power to benefit any developed area. This high point is approximately 10 miles, crow-flight, from the nearest small town of Young Harris.

The Fort Mountain study site was the most promising in terms of SWECS potential. Of the 365-day study period, data revealed 23 days with less than 7 mph average wind speed, 302 days with 7 to 25 mph average wind speed, 10 days with above 25 mph average windspeed and 30 days with equipment down. This study site, as already noted, is also the site of a WCLP-TV transmitting station, a forest service lookout tower, and a state park. A SWECS on this site could benefit facilities in immediate proximity.

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