# WIND UTILIZATION IN REMOTE REGIONS -

# AN ECONOMIC STUDY

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There are presently many diesel generating stations being used in Quebec to supply electrical power to small remote communities. The fuel costs for these stations are very high (5 to 16¢/kW-hr) and will probably become even higher. If a cheaper source of power could be used, substantial savings would result. Wind energy is a good candidate for a new source of power in many remote regions because it occurs in sufficient quantities to drive wind machines. Consequently, an economic comparison of wind generated power to diesel power for a small northern village was made to determine if installation of wind machines would be feasible.

First, we should realize the nature of the remote communities. By definition, they are isolated and undeveloped. Power must be produced locally for short-distance transmission. The communities are generally small with peak demand loads of 30 to 5500 kilowatt-amperes. Power commitments require at least one full capacity standby system. The availability of "natural energy", such as wind, sun, hydro, etc., will vary greatly from one region to another; although sufficient wind energy is available in most regions.

Any power generating system that is selected must be reliable, have long life, easy startup, long unattended operation and be compatible with local means of supply and/or storage. A most important requirement is that the system must be economically competitive.

A wind-driven generator was considered as a supplement to a diesel group, for the purpose of economizing fuel when wind power is available. A specific location on Hudson's Bay, Povognituk, was selected. Technical and economic data available for a wind machine of 10-kilowatt nominal capacity (developed by the Brace Research Institute of McGill Univ.) and available wind data for that region were used for the study. Referring to table I, after subtracting the yearly wind machine costs from savings in fuel costs, a net savings of $1400 per year is realized. These values are approximate, but are thought to be highly conservative.

A very important factor in determining the worthiness of a wind driven system is its duration of utilization. Frequently, there is not sufficient wind when power is needed. Consequently, an energy storage system that would provide power on demand is advisable. Also, a wind

machine and storage system that could be "tuned" to the wind velocity for maximum efficiency would be very advantageous. Pneumatic storage with air-motor driven generators seem to be a good candidate for this type of system. However, some research and development are needed before putting a system into service.

## DISCUSSION

COMMENT: I was interested to see that for the first time the economic value of windpower was compared with the actual fuel saving. When we did our arithmetic on our program, we were only looking for wind power costs. These were equivalent to the fuel costs.

The second point is you had a figure of 58000-kilowatt yearly output from a 10-kilowatt machine. This is 5800 kilowatt-hours per kilowatt, which is about the highest value I have seen for any particular site.

A: Yes. As I said, it's a fairly windy place, but we used real wind data to try to get that estimate. It should be considered fairly accurate.

TABLE I. - EXAMPLE OF WIND MACHINE ECONOMICS (ESTIMATES ONLY)

Location, Povungnituk (pop. 2000).

| Diesel Data | |
|---|---|
| Installed | 250 kW |
| Maximum demand | 90 kW |
| Annual output | 290 000 kW-hr |
| Fuel cost | 6¢/kW-hr |

| Capital Costs | |
|---|---|
| Wind machine | $ 5,000 |
| Generator | 1,000 |
| Transport and foundations | 2,000 |
| Regulation | 5,000 |
| | $13,000 |

| Wind Machine Data | |
|---|---|
| Installed | 10 kW |
| Annual output | 58 000 kW-hr |

| Yearly Costs | |
|---|---|
| Amortization (20 yr) | $ 1,400 |
| Lubrication and Maintenance | 400 |
| Labor | 300 |
| | $ 2,100 |

| | |
|---|---|
| Yearly savings in diesel fuel | $ 3,500 |
| Yearly cost of wind machine | 2,100 |
| Net savings per year | $ 1,400 |