ground cover and topography are dominant in determining these two characteristics but above this level, variations in the wind are the result of horizontal changes in temperature and pressure.

2. ADVANTAGES AND DIFFICULTIES IN USING WIND ENERGY

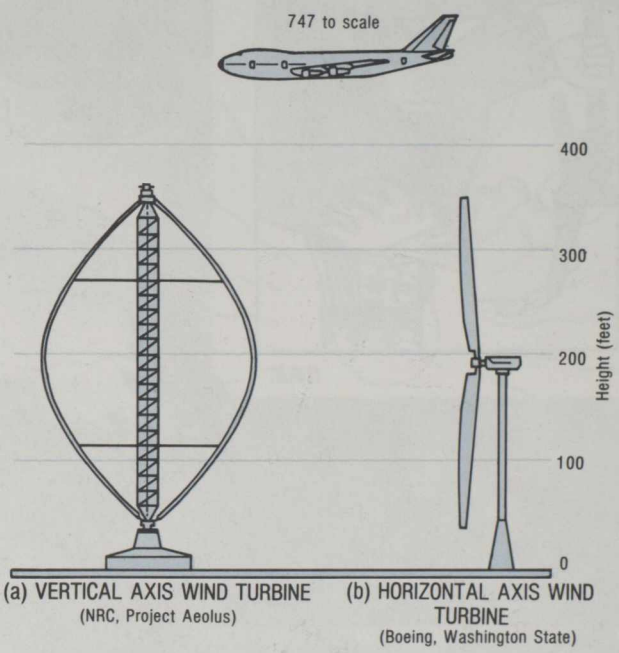
The wind has a number of characteristics which make it an attractive energy source. Like solar radiation it is a free, inexhaustible energy source available everywhere. In Canada we are fortunate in that the areas with the highest average annual wind speed happen to coincide with areas in which conventional energy sources are scarce, such as the Maritimes, Northern Ontario and coastal British Columbia. A windmill delivers high-grade mechanical power which can efficiently be converted into electricity (with no intermediate thermal conversion stage), so even small windmills (5 kilowatts for example) can feed directly into an electrical grid. In areas where capital is scarce and/or energy demand grows slowly, wind power allows supply increments on a smaller scale than is the case with most conventional generating units. The Maritime Provinces are a region where these properties of wind energy systems may prove especially attractive in the near future.

On the negative side the diffuse and variable nature of wind contributes to the high capital costs associated with its exploitation — large, expensive conversion systems are required to capture a significant amount of energy. For example, the 3.8 MW wind turbine to be built by NRC and Hydro Quebec will stand taller than the Peace Tower. The variable nature of wind also means that wind systems cannot provide an uninterrupted energy supply. There are means of overcoming this difficulty by using wind energy in systems where it is not the sole source of electricity or by providing storage facilities, but both add significantly to the cost. Wind turbines can interfere with electromagnetic signals (radar, television and microwave communications), and can generate noise and visual (aesthetic) pollution. These characteristics may pose problems in the future, particularly if one is considering widespread use of this energy source.

3. INTERNATIONAL AND CANADIAN DEVELOPMENT

Research and development of wind energy technology in Canada is directed by the National Research Council. The Canadian program concentrates exclusively on the vertical axis wind turbine (VAWT), while most other countries have invested in the development of horizontal axis wind turbines (HAWT). Figure 6-34 schematically represents these two types of wind turbine. The VAWT is preferred in this country because it is more efficient, extracting more power at a given wind speed than a HAWT. VAWTs have a simpler configuration and operate at a higher speed than other wind turbines, which makes them well suited to electrical generation (as opposed to providing mechanical energy for pumping water). They also offer the advantage of being omnidirectional; that is, they can operate in all wind directions and therefore do not require equipment to move them to face the wind as do horizontal axis turbines. A further practical advantage of vertical axis wind turbines is that their configuration allows most of the machinery which the turbine drives to be located at ground level. This simplifies repair and maintenance procedures.

Figure 6-34: WIND TURBINE CONFIGURATIONS



Source: After Chappell, 1980, 2A:20.

Due to its early entry into the field of VAWTs Canada has a world lead in this technology. Other countries which in the past have concentrated on HAWTs are beginning to realize the advantages of the vertical axis configuration and the United States in particular is putting substantial amounts of money into the development of vertical axis systems.

CONCLUSION

Unless Canada moves quickly into the commercialization and marketing of its vertical axis system, the early advantage which this country holds will be lost.