

## **Vertical Axis Wind Technology “VAWT” – A Proven Wind Technology**

VAWT has been in existence since 200 B.C. The modern VAWT was first patented in France in 1925 and in the U.S. in 1931 by Georges Jean-Marie Darrieus. The VAWT of today is known as the Darrieus-type wind turbine.

The VAWT received little attention until the late 1960s when two Canadian researchers at National Research Council Canada (NRC) recreated the VAWT in a style similar to that invented by Darrieus thinking they had developed a novel technology only to discover that their ‘invention’ had previously been patented by Mr. Darrieus. However, the NRC researchers added a major contribution to the technology when they adopted the Troposkein blade shape to Darrieus’ invention.

In 1973, the U.S. Department of Energy asked Sandia National Laboratories to research and develop alternative energy sources in response to the Arab oil embargo. Working with the NRC researchers that recreated the Darrieus VAWT, Sandia initiated extensive development and testing work on the VAWT. In 1974 and 1975, Sandia reported technical publications on troposkein VAWT.

Sandia concentrated its VAWT development work in 4 primary areas: aerodynamics, structural dynamics, fatigue and reliability, and systems engineering. Sandia made a number of “breakthrough” discoveries as a result of their work with the VAWT, including a structural dynamics computer model that is still used by engineers for VAWT and HAWT simulations.

In 1988, a collaborative project with industry, government and a utility, Hydro-Quebec, in Canada engineered, built and evaluated Eole, a 4 megawatt (MW) VAWT Darrieus-type wind turbine. Eole was (and still holds certain records as) the largest, longest running, most reliable wind turbine of either a horizontal or vertical configuration. Eole operated for 6-years, produced 12,000 MWh of electricity and was available for electricity production 94% of the time...an outstanding performance for a production wind turbine, let alone a prototype. Eole proved that megawatt scale VAWTs were technically and practically feasible and VAWT advantages were confirmed by operational reliability.

Commercial production of VAWT started in the late 1970s by FloWind Corporation and in July, 1995 was operating “*a fleet of 882 wind turbines in the Altamont and Trhachipi passes in California*”

**Ref No 1:** *Wind Energy Weekly #657, July 31, 1995*

At the Canadian Wind Energy conference in September, 1993, Lawrence A Schienbein of Battelle, Pacific Northwest Laboratories gave an important conference on the Darrieus wind technology and its future, reporting over 500 VAWT in commercial operation from 5 manufacturers including FloWind and VAWTPOWER in the U.S. and Adecon in Canada.

**Ref No 2:** (abstract of) *Darrieus Wind Turbine Technology - Past, Present and Future*

In October 1993, NRC published the evaluation report on Eole, the Hydro-Quebec 4-MW VAWT installed at Cap-Chat, Quebec, stating “*An overall availability in excess of 94% is outstanding for even production of Wind Energy Conversion Systems (WECS) of that era, let alone a megawatt-scale prototype*”. Clearly, at the time of the 6-year period of the evaluation, Eole had unsurpassed performance in the harsh Cap-Chat climate.

**Ref No 3:** *Project Eole – A Retrospective, Bulletin, October, 1993*

Today, some FloWind and Adecon derived wind turbines (Chinook 2000) have logged decades of commercial operation. While the companies failed for business reasons, functionality of the VAWT technology was not the issue as many of the VAWTs installed by the two companies continue to operate and produce electricity 20-years later!

Darrieus-type VAWT technology of today represents proven North American technology (Canada and USA) as a result of approximately US\$100 million in development expended primarily by NRC and Institut de Recherche de Hydro-Quebec in Canada and Sandia in the U.S. DERMOND’s patent applied for improvements represent a simplified and advanced model of this proven VAWT.