"GELIBOLU MODEL" WIND TURBINE (GMWT) (*)

Characteristics:

GMWT is an advanced vertical-axis-wind-turbine (VAWT), consists of vertical "DARRIEUS" type rotor-blades, equipped with three specially designed "AUGMENTATION AND DIRECTIONING WINGS" (AADW) (Fig-1).

Patented AADW wings give an additional vacum (lift) force to the rotor-blades of GMWT, while increasing the total efficiency of comparable VAWTs (vertical-axis-wind-turbines) up to 5 times, also easily adjust the right angle to the direction of the wind without any additional power and/or directioning equipment, thanks to their special design (Fig-2).

The swept area is only ($1/5^{th}$) of any other comparable VAWT turbines, (i.e.SAVONIUS, DARRIEUS or GIROMILL), while producing the same amount of power. Therefore any scientific and/or commercial discussion is acceptable, related to the obtainable power from any HAWT or VAWT turbines, regarding the items of "swept area", "total investment per KW", "capacity factor" & "capacity cost", "cost per kWh", "total land required" and "related investment", "operation and maintenance costs" and "availability" points of view, comparing with GMWT.

The special design of AADW decelerates a larger portion of the wind, more then does the swept area of GMWT; therefore according to the "BETZ Limit Theorem", the denominator value of the proportion of formula, is seriously changed. The denominator of the proportion changed from the force of wind streams opposite to the swept area, but-more correctly-to the large "augmented area" by the AADW wings, creating a superb efficiency comparing the same swept-area of VAWT's.

(Needless to explain that the BETZ Limit theorem is correct. But this theorem only regards the "projected area" of a wind turbine as the denominator value, while calculating the efficieny of turbine, not the "affected-augmentation area". But there must be regarded as special type wind turbine goemetries (i.e., GIROMILL, TORNADO, HAWT's angled tip vanes, and GELİBOLU, the proportion must be changed, the wind power to the "augmented area" as denominator, which is larger than the projected area.)

Please notice the following example:

COMPARISONS OF OPERATIONAL FORCES IN VERTICAL AXIS WIND TURBINES (VAWT) AND GELİBOLU MODEL WİND TURBINE (GMWT) TURBINES

İN ANY OTHER VAWT TURBINE ========== (+) POSITIVE DRAG AND LIFT FORCES: (i.e. 6 KW) (-) NEGATIVE DRAG AND LIFT FORCES: (i.e. 4 KW)	IN GMWT ======= (+) POSITIVE DRAG AND LIFT FORCES: 6 KW (+) ADDITIONAL LIFT POWERS : 4 KW
= TOTAL POWER (REST)=2 KW	TOTAL POWER = 10 KW
Only for (swept-area)	(AUGMENTED AREA)

Result: The formulation tested with operational models. The GMWT has up to 5 times more power for the same projected area of any other VAWT's. (APPENDIX 1 and 2) (At the same test conditions).

FEATURES OF GMWT WIND TURBINES:

- Only 0,20 the swept area of VAWTs, for the same power (KW).
- No need for: DIRECTIONING EQUIPMENT (GELİBOLU is aerodynamically self-adjusted).
- No need for: HUB, NACELLE, YAWING EQUIPMENT (Simple equipment needed for only power-decreasing).
- Special geometry of turbine is more convenient for multi-pole ring generators (Low RPM, large diameter, i.e. ENERCON).
- More energy yield annualy (up to 2 or more times, comparing to any VAWT or HAWTs) (HIGHEST OVERALL EFFICIENCY)
- Large Operational Wind speed limits: (cut-in, cut-out range)
    - cut-in (As low as>2m/s)
    - cut-out (Almost no upper limit, up to the "survival wind speed" or the ultimate capacity of generator; no limit for turbine itself).
- Larger survival wind speed (larger than any VAWT or HAWTs): (Thanks to volumetric and strong design)
- Comparingly shorter tower height, and decreased investment for it.: (for the same amount of KW installed).
- Less number of turbines (GMWT) and less "land area" (site) required.: (for the same amount of KW installed).
- Higher "Capacity Factor" (not less than %50, technically, in any convenient sites) (Appr.full power at the half of the year, or more).
- Comparingly low "Capacity Cost", to any HAWT or VAWT turbines (*)

"CAPACITY COST" COMPARISONS OF WIND TURBINES (*)			
Commercially Available WIND TURBINES	(A) CAPACITY FACTOR	(B) CIF Installed COST ($/KW)	(C) CAPACITY COST ($/KW)(%100) (C=B/A)
HAWT (Horizontal axis)	%27-%30	$1.050-$1.300	$4.333-$4.815
VAWT (Vertical axis)	%20-%25	$1.300-$1.600	$5.200-$8.000

"GELIBOLU MODEL WIND TURBINE" (GMWT)			
At the stage of: PILOT PRODUCTION	%50-%65 (Min.)	$1.050-$900	$2.100-$1.308
SERIES PRODUCTION:	%50-%65 (Min.)	$900-$700	$1.800-$1.077

NOTES: (*) Installed at similar sites and conditions of wind.

- Very low electrical energy production cost (cent/kWh)
  (As low as 2-2,5 cent/kWh, depending on turbine size and wind regime in convenient sites of wind turbine farms)
- Two or more storied construction: Equipped with seperate energy units.
- Real multi-megawatt turbines=
  (Convenient structural advantages and special turbine geometry for several MEGAWATT turbines).
- UNIQUE FEATURE: Ideal for "sea" and "off-shore" applications
  (Floating platform of GMWT cuts half the cost of investment for off- shore HAWTs. No need for underwater foundations. Simply float GMWT, and yield power).