HIGHER TECHNICAL INSTITUTE

NICOSIA – CYPRUS

MECHANICAL ENGINEERING DEPARTMENT

DIPLOMA PROJECT

DESIGN OF A WINDMILL PUMPING SYSTEM FOR IRRIGATION PURPOSES

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DESIGN BY :

EFTHYVOULOU *COSTAS*

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CHAPTER 1

The Nature of the Wind

The circulation of air in the atmosphere is caused by the non-uniform heating of the earth's surface by the sun. The air immediately above a warm area expands, it is forced upwards by cool, denser air which flows in from surrounding areas causing a wind.

The nature of the terrain, the degree of cloud cover and the angle of the sun in the sky are all factors which influence this process. In general, during the day the air above the land mass tends to heat up more rapidly than the air over water. In coastal regions this manifests itself in a strong onshore wind. At night-the process is reversed because the air cools down more rapidly over the land and the breeze therefore blows offshore.

The main planetary winds are caused in much the same way: cool surface air sweeps down from the poles forcing the warm air over the tropics to rise. But the direction of these massive air movements is affected by the rotation of the earth and the net effect is a large counter-clockwise circulation of air around low pressure areas in the northern hemisphere, and clockwise circulation in the southern hemisphere. The strength and direction of these planetary winds change with the seasons as the solar input varies.

Despite the wind's intermittent nature, wind patterns at any particular site remain remarkably constant year by year. Average wind speeds are greater in hilly and coastal areas than they are well inland. The winds also tend to blow more consistently and with greater strength over the surface of the water where there is less surface drag.

Wind speeds increase with height. They have traditionally been measured at a standard height of ten metres where they

are found to be 20-25% greater than close to the surface.

At a height of 60m they may 30-60% higher because of the reduction in the drag effect of the earth's surface.

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