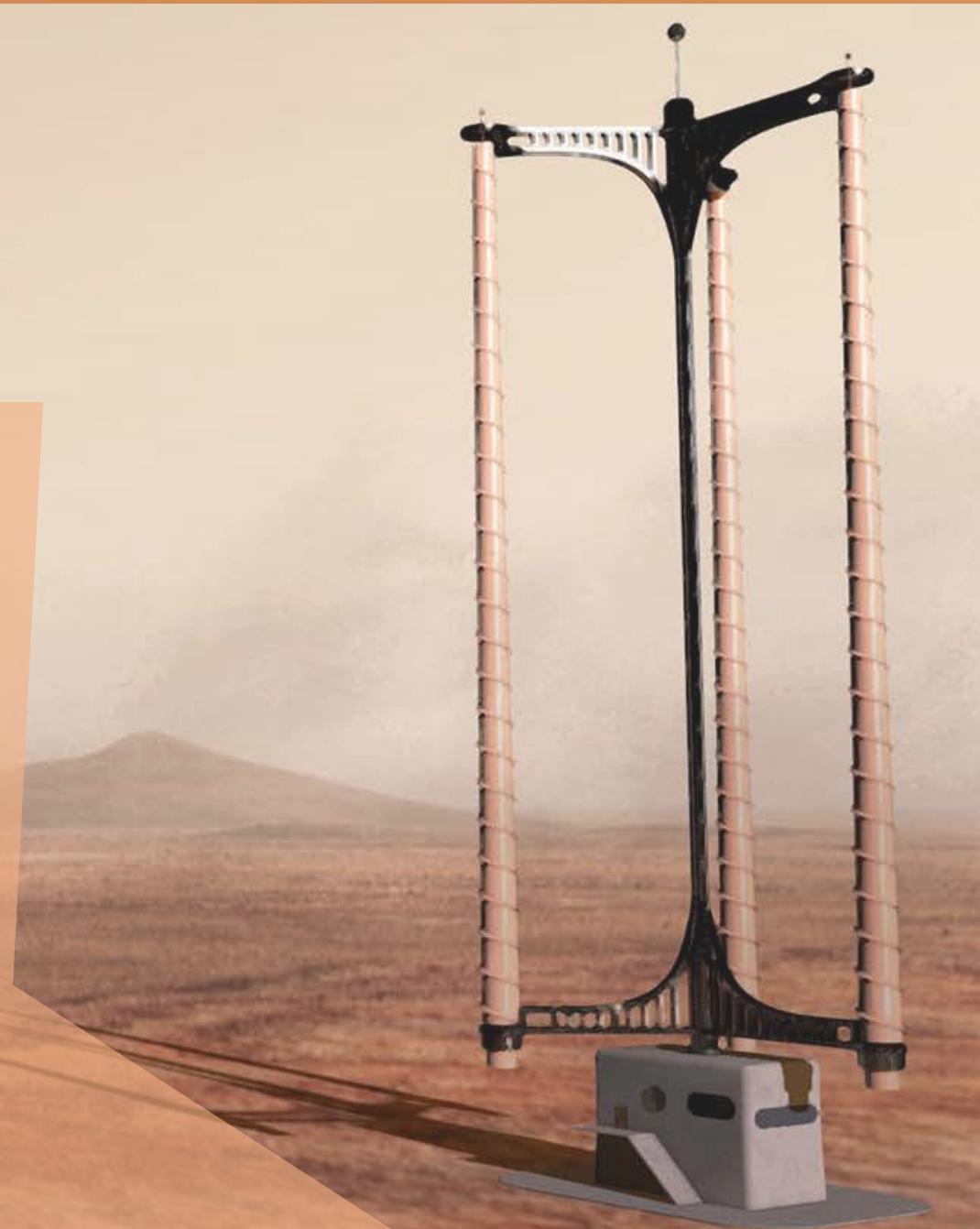


MARS V.A.S.M STORM TURBINES

VASM turbine stands for **vertical axis spiral magnus** turbine .It operates using the principle of **Magnus Effect**. It is specially designed for harnessing energy from the strong dust storms in mars as well as reducing its strength when arranged in grid. It is a bladeless turbine ,thus can prevail in storm where the conventional turbine may fail .

On earth ,vegetation help in reducing the damaging effect of storms and typhoons . These turbines can help in similar way when arranged in a grid surrounding a Martian city. It can stand as a wall against dust storm and protect Martian colonies from it .

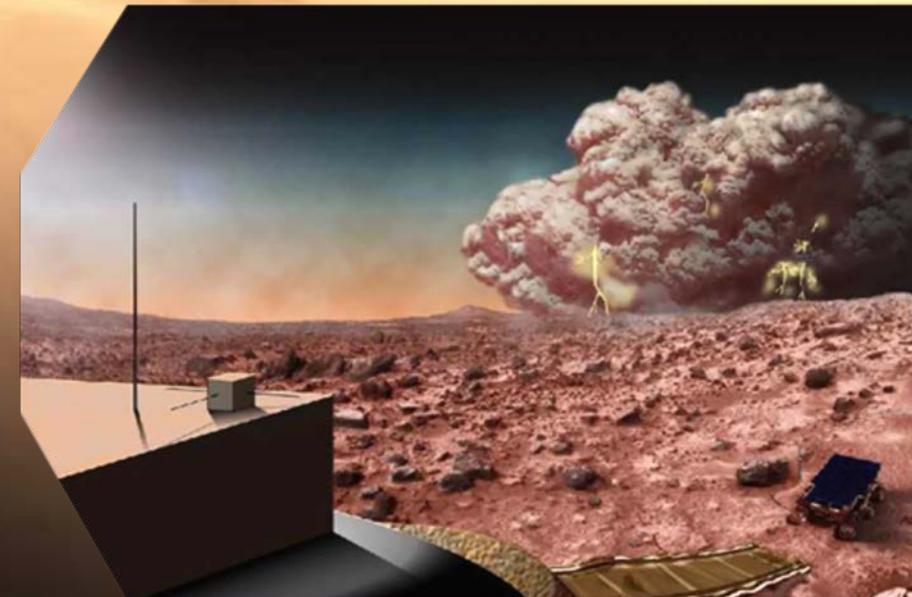
It can provide power and protection at the same time .



The Dust Storms in MARS

Every year there are some moderately big dust storms that pop up on Mars and they cover continent-sized areas and last for weeks at a time. Beyond Mars' large annual storms are massive storms that occur more rarely but are much larger and more intense.

Large global dust storms put enough dust in the air to completely cover the planet and block out the sun. Dust particles on Mars are electrostatic and produce lightning. They stick to the surfaces of solar panels and decrease its efficiency.



The background image shows a Mars rover on the left side, partially obscured by a large, billowing dust storm that fills the center and right of the frame. A bright sun is visible in the upper center, partially obscured by the dust. An astronaut in a white spacesuit is visible in the lower right foreground, looking towards the storm. The overall scene is a dramatic depiction of a Martian dust storm.

The winds in the strongest Martian storms top out at about **90 km per hour**. Though the atmosphere on Mars is about 1 percent as dense as Earth's atmosphere, existence of the dust particle creates the main problem.

Harnessing energy from solar becomes obsolete during the storm. This idea suggests a **Bladeless Vertical Axis Wind Turbine** which is equivalent in size of our conventional wind turbine and capable of **harnessing energy from storm wind**.

The conventional wind turbine fails in storms but the bladeless turbine can prevail such harsh condition. As the gravity is **1/3rd of earth**, large turbines can be built using **strong and light materials**.

V.A.S.M STORM TURBINE The Features:

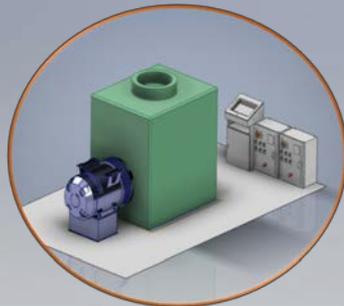


Lightning rod:

Martian dust storms are electrified and cause lightning. The tall turbines are prone to these lightning. To protect it, "lightning rod" is used to redirect current to ground. It may possible to harvest energy from these lightnings.

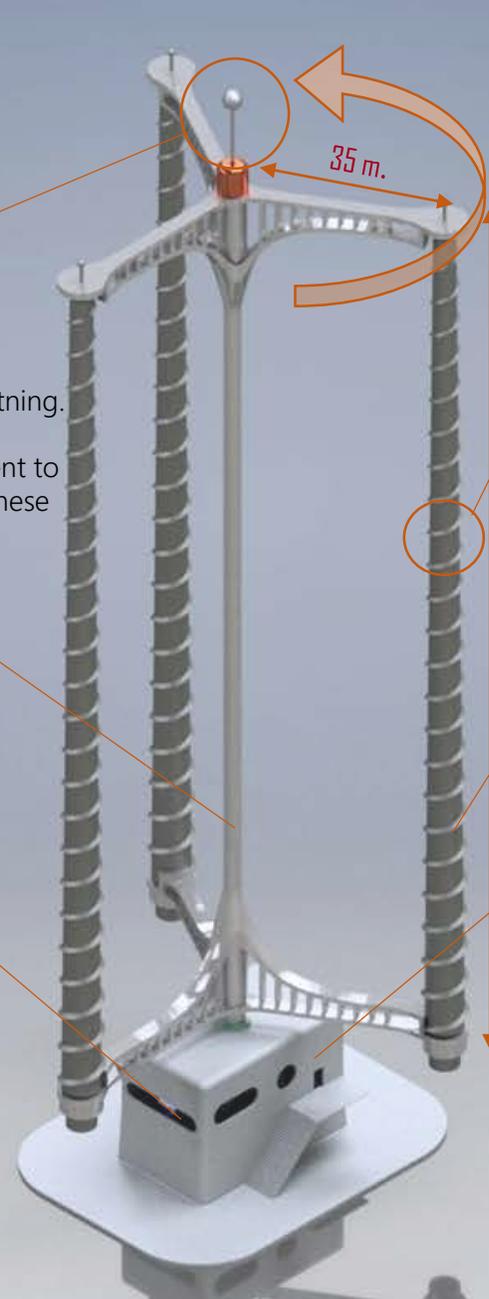
Prime rotor frame:

It encompasses the Magnus rotors and mounted on a supporting axle. The other end is connected with a generator through a gear train. It rotates because of the moment produced by the magnus force acting on the rotor.



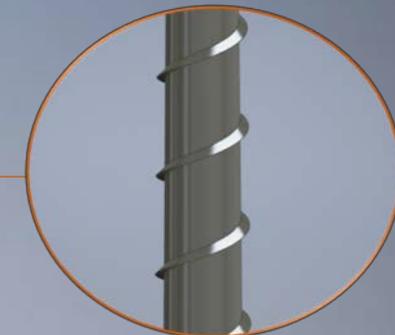
Control desk and Generator:

Wind turbine of this size can produce several Giga watt hour of electricity during large dust storms and provide energy when other alternative source like solar is unavailable.



35 m.

160 m.



Spiral blades:

It helps rotor to rotate in a specific direction regardless of the direction of flow. In the given diagram, rotor always rotates in anti-clockwise direction.

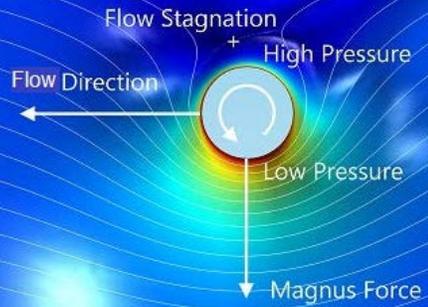
Magnus rotor:

Specially designed to rotate in high speed wind. Slightly tapered. Wind speed increases with increase in height. As
 $\text{Magnus force} \propto \text{wind speed}$
Cross-section decreases with increase in height to facilitate even distribution of force on rotor.

Energy station:

Station can be built under the turbine which encloses the control room, generator and transformers. It is a insulated pressurized cabin separated from atmosphere. Martians can dwell inside it under controlled temperature and pressure. As the important components are close to ground, repair and maintenance is easy.

MARTIAN STORM WIND FARM



Magnus Effect applied on a single rotor

These bladeless vertical axis wind turbines can be arranged in a grid on the plains of Mars. These wind farms can generate required electricity during the storm as well as behave as a wall against it. It will reduce the strength of the storm by harnessing energy from it and protect the Martian colony.

As the speed of storm is decreased by the wind farm the dust may settle way soon before reaching the Martian colony.



Martian dust storms are not strong compared to the storms on earth. But as the storms contains little dust particle which may cause problem within moving machineries if accumulated in them .

During storm the wind flow direction may change very rapidly. Thus conventional wind turbine may have to adjust their yaw accordingly. As for large horizontal axis turbine ,it may be difficult to change their yaw at such speed ;they can't work efficiently and may stall in these environment. When the turbine nacelle moves, the dust particle may enter through the gap and damage the components.

The vertical axis turbine is suitable for this environment as there is no need of any yawing mechanism. The turbine will rotate in wind flow from any direction .The generator gearings can be placed inside the station at the bottom of the turbine, where repair and maintenance can be done easily.

Wind speed at the edges of the crater is more than at its valley region. The wind farm can be built on the edge of a crater or basin to produce large amount of electricity . Power transmission line will be under ground. Coolants can be used to cool down the large generators and It will exchange heat with outer atmosphere.



It will be a environment friendly energy source, thus making Mars more inhabitable. It will be mankind's first step toward making Mars green.

The future with Wind farms

A Future Martian
colony using wind
farm as energy
source .

Thanks for
Watching

Martian colony

Wind turbine grid
surrounding the
colony.

