Recursos educativos
Energía Eólica

Wind Farms

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1.What is a wind power station?

A wind farm is an electric power station where the production of electric energy is achieved using the force of the wind, by means of aero generators that take advantage of the air currents.

The wind is an effect derived from the uneven heating of the surface of the Earth by the Sun.

The main problem of the wind farms is the unavailability of the wind when it is required. This implies that the wind energy cannot be used as the only source of energy and must always be backed up by other sources of energy with a greater regulation capacity (thermal, nuclear, hydroelectric, etc.).

In order to take advantage of this wind energy the aero generators are used.

2. The aero generator

An aero generator is an electricity generator activated by the action of the wind. The wind moves the helix and by means of a mechanical system of gears making the rotor of a generator revolve, generating electric current.

The main components of an aero generator are the following:

- The pod: is the chassis protecting the key components of the aero generator.
- The rotor blades: they capture the wind and transmit their power towards the hub. They have a length of 20m.
- The hub: is what joins the blades of the rotor with the low speed shaft.
- The Low speed shaft: connects the hub of the rotor to the multiplier. It turns very slowly, at 30 rpm.
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The multiplier: allows the high speed shaft on its right turn 50 times faster than the low speed shaft.

- The High speed shaft: turns approximately at 1,500 rpm, which allows the operation of the electricity generator.
- The electricity generator: in the modern aero generators the maximum power is usually between 6 and 12MW.
- The electricity controller: is a computer that continuously monitors the conditions of the aero generator and controls the orientation mechanism.
- The cooling unit: It includes an electric fan used to cool the electricity generator.
- The mast: supports the pod and the rotor. Having a high mast is generally an advantage, as the wind speed increases the further away we are from the ground.
- The orientation mechanism: is activated by the electronic controller, monitoring the direction of the wind using a panel.
- The anemometer and the panel: the electronic signals of the anemometer connect the aero generator when the wind has an approximate speed of 5m/s.

3.Types of aero generators

Currently there is a wide range of models of aero generators that are different with regards to their power, number of blades or even the way of producing electric energy, depending on various factors:

Position of the aero generator

Vertical shaft: its main characteristic is that the **rotation shaft is in a perpendicular position to the ground**:

- Darrieus: consists of two or three aerofoils turning around the shaft.
- Panemonas: four or more helicoids joined to the central shaft.
- Sabonius: Two or more rows of semi-cylinders placed facing each other.

?**Horizontal shafts**: are the most usual and in which the greatest effort for their improvement has been made in the last few years. They are also called ?HAWTs? (Horizontal Axis Wind Turbines.

Orientation with regards to the wind

- Upper wind. Most of the aero generators have this design. In this type of aero generators the wind

starts to deviate from the mast before it reaches it, even if the mast is round and smooth.

- Lower wind. The low current machines have the rotor located on the lower wind side of the mast. They can be built without an orientation mechanism.

4. Operation of a wind power station

To produce electricity from a wind power station the wind has to blow at a speed of between 3 and 25m/s.

The wind makes the blades turn when it blows on the same, thus transforming the kinetic energy intro mechanical energy which is transmitted to the rotor. This energy is transmitted by means of a low speed shaft to the multiplier box, from which it leaves at a speed of 50 times faster. It is then when it can be transmitted to the shaft of the electricity generator to produce electric energy.

Static electricity is created in an aero generator as the wind brushes against it. This accumulated static electricity is discharged from a device in the ground that all aero generators have. This device in the ground is installed as, given the height of the mast, a difference in power between the soil and the aero generator is produced.

You have available an interactive game which explains the operation of the wind farms in a more graphical way .

5. The aero generators and the environment

Wind energy is one of the cleanest, most renewable and abundant types of energy, as electricity aero generators do not produce contaminating emissions (atmospheric, waste, liquid spillages?) and therefore do not contribute to the greenhouse effect or acidification.

But there are also negative factors, some of the environmental consequences being the following:

- The visual impact. While a farm with only a few aero generators might even be considered as attractive, a large concentration of machines poses a series of problems. To prevent this, suitable colours are usually used, as well as a specially selected location of the installations in the orography of the area and a precise distribution of the aero generators.

- The impact on birdlife. This is a potential impact that, although it is not very serious in general terms, it mainly depends on the location of the wind farm. Those farms which are located in sensitive areas can be minimised by means of monitoring and follow-up programmes.

- Flora and fauna. A wind farm can have direct effects on the modification of the existing habitat in the area and on some of the organisms inhabiting the same, generating noises and movement that affect the behaviour of the animals.

- The sound effect. An aero generator produces a noise similar to that of any industrial equipment of the same power. The difference is that while the conventional equipment is usually found in buildings designed to minimise their noise level, the aero generators are in the open air and have a sound-transmitting element: the wind itself.

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The erosion impact. They are mainly produced by the movement of the land during the preparation of the accesses to the wind farm. This can be decreased by means of studies prior to their layout.

- The electromagnetic interferences. The large size of the aero generators can produce interference in the radio, telephone, television waves when the blades are in movement.
