

Tribological aspects of wind and water power plants

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ABSTRACT – The targets for the future are concentrated on the following considerations:

- a. Saving of resources, because they are limited
- b. Protection of the environment, because the humanity (mankind) has to survive.

We have to take into account the depletion of conventional raw materials, e.g. crude oil, coal, metals and non-metals, because they will run out during the next some hundred years. But sun, wind and water energy are available for ever. Today we have to rely to the following energy carriers:

- a. Conventional carriers like crude oil and natural gas
- b. Biomass
- c. Hydrogen
- d. Electricity

But electricity has to be produced by sun, water and wind energy. As long as mechanical devices for the production of electricity are needed we have to take into account tribological systems with friction, wear and lubrication aspects.

1. WATER ENERGY CONTENT

There exist 3 possibilities to use the energy content of the movement of water to the turbines:

- a. Flowing river or flowing from high levels to low levels and driving turbines.
- b. The movements of waves can be used to drive turbines
- c. The flowing water caused by the tide can be used to drive turbines.

As frictional systems bearings, gears and hydraulics have to be operated. Lubricating greases, bearing lubricating oils and hydraulic oils will be used.

2. WIND ENERGY CONTENT

Note Wind energy is the number one choice in Europe's effort to move towards clean and renewable power. The power output of existing wind energy plants is between 0.5 and more than 7.5 MW. The challenges of wind farms are the strong wind of up to 35 km/h and winter storms with up to 165 km/h. The large wind energy plants need pylons with a height up to 150 m and blade length of 80 m and more. Especially for the off-shore wind parks risky helicopter landings are necessary for maintenance and repair purposes. The expected life time of the main gears is 20 years with maintenance and oil change periods of 5-7 years. New developments are characterized by direct driven generators (renounce of main gear).

The frictional contacts are the main bearings, the gear boxes, the hydraulic systems and the yaw mechanisms. Therefore the following lubricants are needed: CLP Gear Oils, Open Gear Lubricating Greases, High Performance Greases and HLP Hydraulic Oils.

3. SUMMARY

As summary the percentages of basic resources to produce energy are compared.