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SOURCES FOR FUTURE ENERGY CARRIERS: WATER ENERGY – TRIBOLOGICAL ASPECTS

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Abstract: *The targets for the future are concentrated on the following considerations: saving of resources, because they are limited; and protection of the environment, because the humanity (mankind) has to survives. We have to take into account the depletion of conventional raw materials, e.g. crude oil, coal, metals and non-metals, because they will ran 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: conventional carriers like crude oil and natural gas; biomass; hydrogen; and 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.*

Keywords: *depletion of raw materials, future energy carriers, using water energy content: flowing rivers, tidal water flowing, wave moving.*

1. INTRODUCTION

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

- Saving of resources, because they are limited;
- Protection of the environment, because the humanity (mankind) has to survives.

We have to take into account the depletion of conventional raw materials, e.g. crude oil, coal, metals and non-metals, because they will ran out during the next some hundred years (Fig. 1).

2. FUTURE ENERGY CARRIERS

But sun, wind and water energy are available for ever. Today we have to rely to the

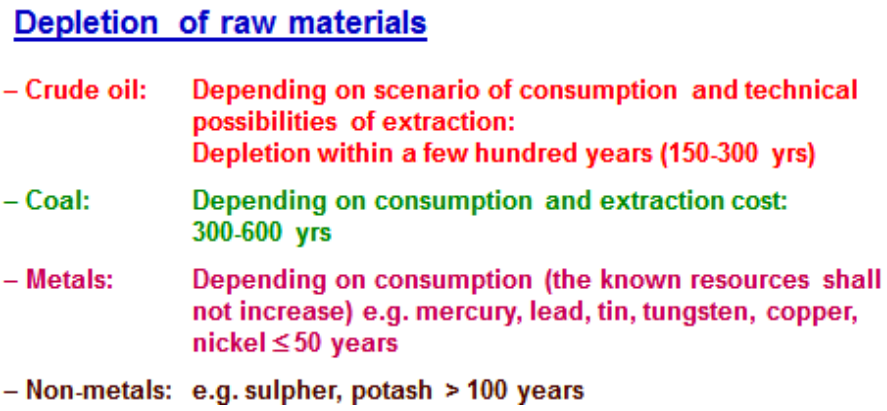


Figure 1. Example for the depletion of raw materials

following energy carriers:

- Conventional carriers like crude oil and natural gas;
- Biomass;
- Hydrogen;
- 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.

3. WATER ENERGY CONTENT

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

- Flowing river or flowing from high levels to low levels and driving turbines;
- The movements of waves can be used to drive turbines (Fig. 2);

The flowing water caused by the tide can be used to drive turbines (Fig. 3).

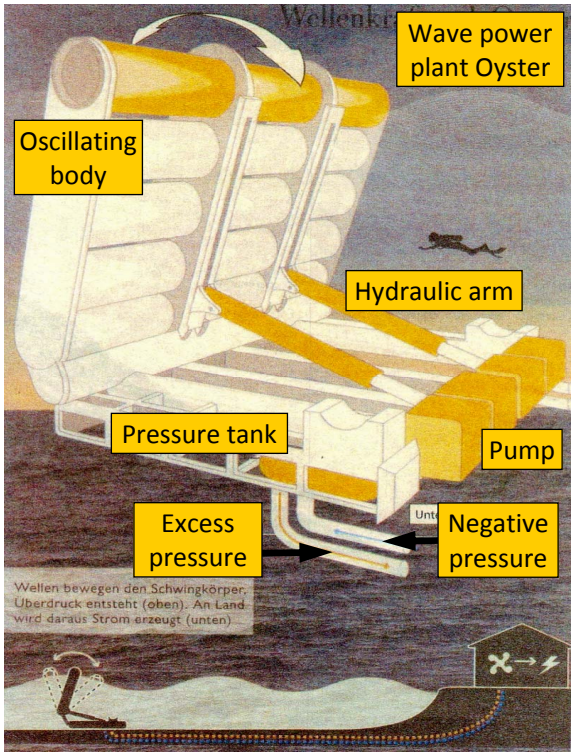


Figure 2. Example for wave power plants (waves move the oscillating body forward and backward producing pressure differences resulting in an operation of a hydraulic cylinder by pressure differences)

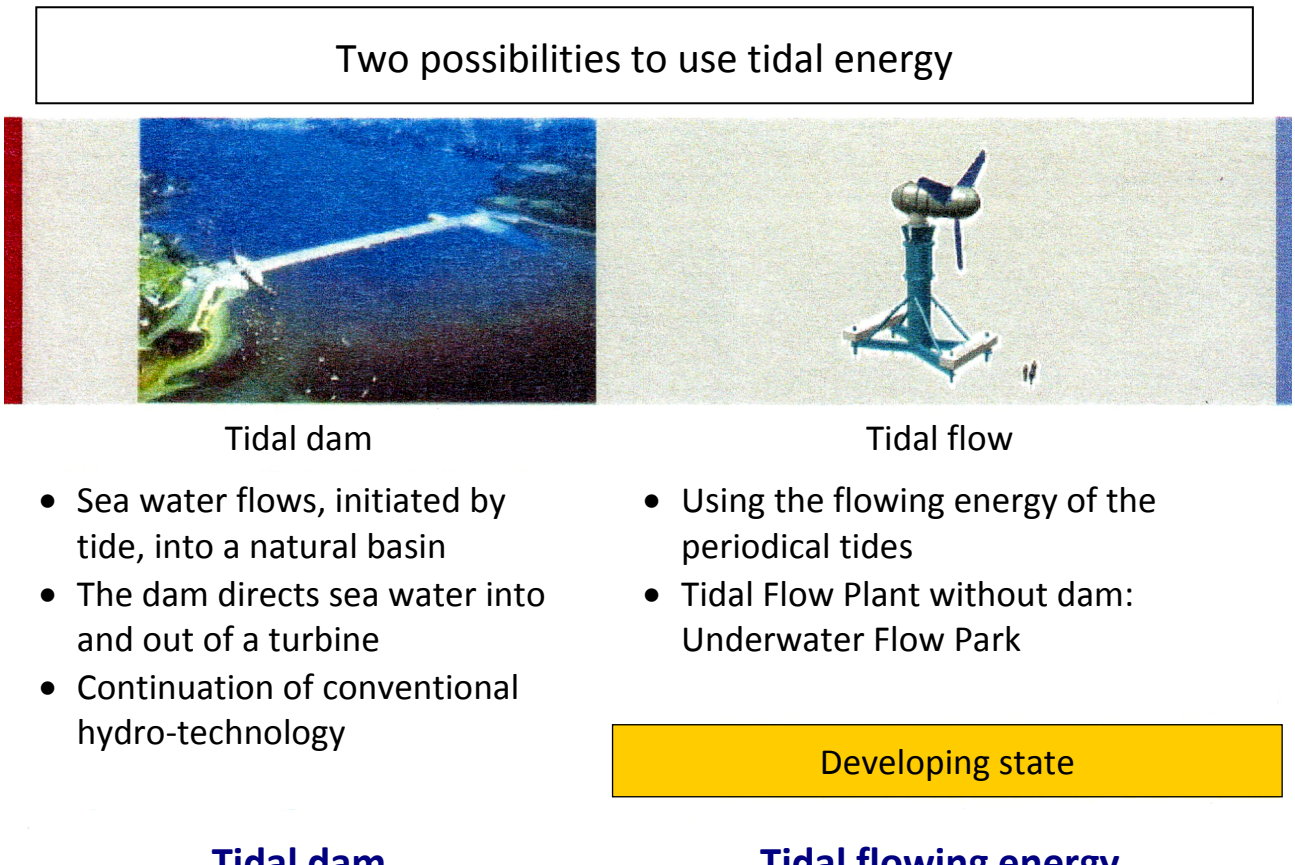


Figure 3. Example for tidal plants

As frictional systems bearings, gears and hydraulics have to be operated.

Examples bearing systems:

- Concept of an energy producing line (Fig. 4);
- Large bearing system (Fig. 5).

Lubricating greases, bearing lubricating oils and hydraulic oils will be used.

4. CONCLUSION

As summary the view of an existing hydro power plant working in Guigang, China, is shown (Fig. 6).

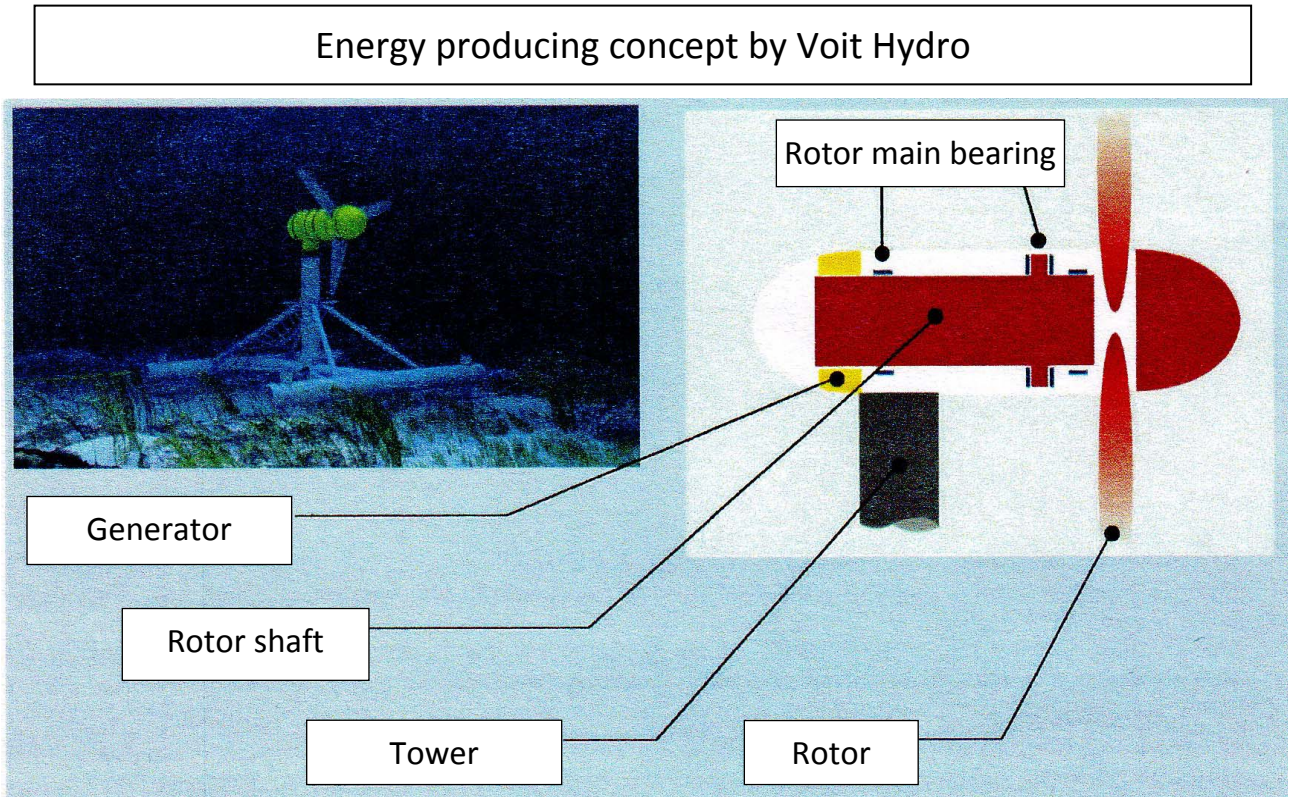


Figure 4. Concept of an energy producing line

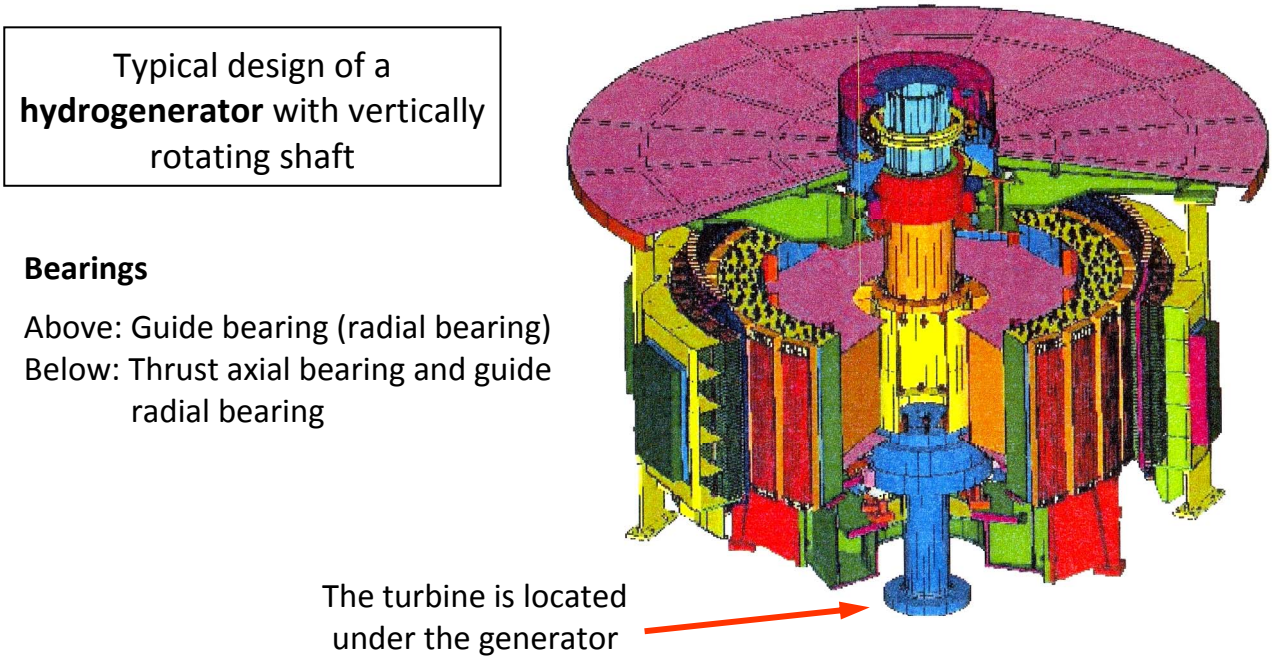
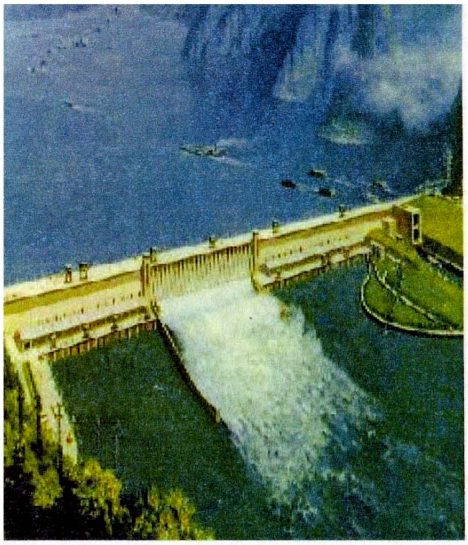
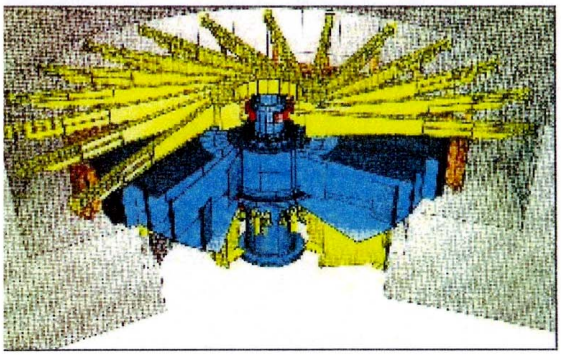


Figure 5. Example of large bearing system





Three Gorges / China

Planned total power: 18200 MW

26 Generators

- Low speed generator
- Driven by Francis-turbine
- 8 Generators, left side
  778 kVA, 700 MW, 75 rpm
- Plant with worldwide highest power
- Bearing data (Tilting pads)

NDE-side:
Guide: d = 2200 mm

DE-side:
Thrust: d = 5200 mm
f = 5520 t
Guide: d = 5200 mm

Turbine side:
1 guide bearing

Figure 6. An existing hydro power plant working in Guigang, China