Alternatives to francis turbine

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In the non-modernized runner geometry adapted from the Ilha Solteira Francis turbine blades, the insertion of leading-edge tubercles configuration 4L with R W = 0.25 increased torque generation by up to 1.77% due to the pressure increase in the blade suction side leading-edge. However, it also raised head loss by 4.13%, resulting in a reduction ...

Hydroelectricity accounts for 63.8% of Brazilian electricity, but several of the country"s power plants require modernization. For this, the insertion of leading-edge tubercles is an alternative since this device improves wind and tidal turbines. Surprisingly, no study explored the device"s potential for hydraulic turbine improvement.

A widely used turbine type is the Kaplan Turbine, looking very much like a giant propeller. Its efficiency is very high, it can "capture" over 90% of the kinetic energy of the outlet stream. Today, however, another turbine type is taking over - namely, the Francis Turbine (Fig. 5.11). It was invented 170 years ago by a Massachusetts ...

On the other hand, thanks to its high efficiency at low flows, the Kaplan turbine can be an appropriate alternative to the Francis turbine. The final choice of which turbine (s) to select for a RoR plant warrants a detailed cost benefit analysis along with turbine technical constraints.

Semantic Scholar extracted view of "Leading-edge tubercles as an alternative to increasing a Francis turbine torque generation" by Henrique M. Campos et al.

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The kinetic energy of the “water jet” is harnessed and converted to mechanical work (needed for turning the electricity generator). A widely used turbine type is the Kaplan Turbine, looking very much like a giant propeller. Its efficiency is very high, it can “capture” over 90% of the kinetic energy of the outlet stream. Today, however, another turbine type is taking over – namely, the Francis Turbine (Fig. 5.11). It was invented 170 years ago by a Massachusetts engineer James B. Francis. Mechanically, it’s design is more

complicated than that of the Kaplan turbine. Also, its efficiency is slightly lower than the Kaplan’s turbine efficiency. Yet, it has one considerable advantage over the Kaplan type – name, it is a reversible machine,

Figure 5.10: The flow of water in the Francis turbine (left diagram – see the text for more explanation) and, in the right, a photograph of a real turbine with partially exposed elements, the yellow vanes and the red runner (source: Wikimedia Commonas).

it can work in two directions: (i) as a turbine harnessing the energy from down-flowing water, and (ii) as an electric motor-powered pump, capable of lifting water from one reservoir to another one, located much higher (even 2000 ft. higher). Such capability makes the Francis turbines especially valuable in Pumped Storage Hydroelectic Plants (PSHP) which are becoming more and more popular – we will return to the discussion about the advantages of pumped-storage plants later in this Chapter.

However, an even better way of explaining the Francis’ turbine operatio n principle is definitely to use a dynamic video presentation – for instance, one such piece worth recommending is this one.