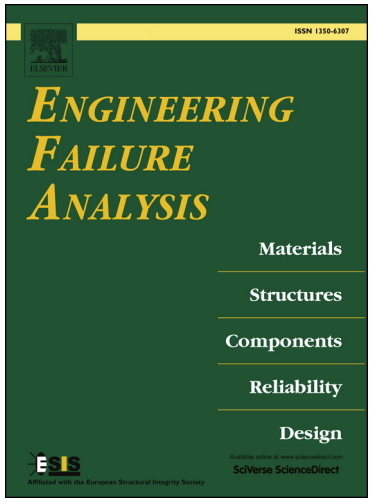

Hydro turbine failure mechanisms: An overview

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Hydro turbine failure mechanisms: An overview

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Abstract:
Turbine failure not only increases the plant down-time and brings about revenue losses but also poses a serious threat to the life of the operational and maintenance personnel especially when the power house is underground. There are basically four main failure modes identified in open literature. The current article presents an overview of these four hydro turbine failure modes based on an extensive literature review and also field observation from the Tala Hydropower Plant, Bhutan. Moreover, the report provides information about different turbine parts that are more likely to be liable to damage under these failure modes. It also attempts to elucidate some recommended methods to prevent/mitigate against these failure modes.

Key words: hydro turbines, cavitation, erosion, material defects, fatigue

Introduction
Hydropower is currently the most important renewable source of the world's electricity supply and there is still a considerable untapped potential in many areas. Continued exploitation of this resource is likely as a response to the world's demand for energy. Environmental legislation such as the Kyoto Protocol is putting increasing pressure on all governments to generate clean energy from sustainable sources. Hydropower is amongst the key answers to the environmental issues. According to the report on the structure of renewable energy resources harnessed as of 2008, indicates 86.31% of the renewable energy is generated by hydropower plant, [Lejeune & Hui, 2012]. Table 1 provides a comparative indication of the renewable energy sources tapped as of 2008.

Source	TWH	%
Hydropower	3247.3	86.31
Biomass	223.5	5.94
Wind power	215.7	5.73
Geothermal	63.4	1.69
Solar including photovoltaic	12.1	0.32
Marine energies	0.54	0.014
Total	**3762.54**	**100**

Table 1: World's renewable energy harnessed as of 2008, [Lejeune & Hui, 2012].

The values in Table 1 confirm the importance of hydropower development against the other renewable methods of producing energy such as biomass, wind, geothermal, solar and marine energies. However, hydropower plant may be subject to a number of constructional, operational and maintenance problems that could reduce the plant electricity generation capacity. Moreover, the plant may suffer huge revenue losses due to several teething problems which ultimately increase the down time of the plant. One such problem is the hydro turbine and its components