Wind load analysis for structural design of a parabolic trough concentrator

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Theoretical investigation of the effect of wind on parabolic trough type solar energy concentrator (PTC) with reference to geographical and metrological parameters of Hambantota (semi-desert zone) is reported. It has been found that the maximum daytime wind speed reported (on non-disastrous situation) is around 8.3 m s-1 which is a Fresh breeze situation. Beaufort number 5 has been assumed for calculating the wind load. Terrain factor of 1/7 (open country) has been selected after considering nature of the terrain of semi-desert zones of Sri Lanka. Maximum drag coefficient for the shape of parabola used in the study has been found from tables as 2.0. The mean wind load applied on the PTC of dimensions 4.5 m × 4.8 m and the aperture area of 22.3 m2 has been calculated is by assuming quasi-steady conditions and the value was found to be 1.3 kN. Weather gust factor is also included in order to deal with more practical situations, and it is found that the maximum wind load and torque are 3.19 kN and 3.64 kNm respectively for a gust factor of 1.53. It has been found that the maximum load calculated with the gust factor is compatible with the values obtained by assuming light gale conditions (wind speed around 12.7 m s-1) with a laminar flow.

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