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A new technique to improve expected aep estimation in very complex terrain**

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Annual Energy Production (AEP) estimation is a key issue in the development and financing of wind projects; it is fundamental not only for investment evaluation but also in defining the plant lay-out and dimensions. In order to obtain reliable results, detailed analysis of the wind conditions is needed; for wind sites in complex terrains each stage of this analysis is more difficult than in flat land because of the particular wind field conditions that are characterized by high turbulences and different shapes of the wind profile. It is not well known how these conditions affect wind turbine operation; as a result wind energy production can be different than expected. This is mainly due to the misunderstanding of the wind flow characteristics and the turbine efficiency. The present work is focused on a new method which takes into account the effect of orography in terms of available energy rather than the efficiency for the conversion. A technique to customize power curve is proposed and applied with success in the test case of Fossato di Vico (ITALY) wind farm bringing error in estimating AEP below 10%. Present work has been carried out with Anemon s.p.a. (ITALY) which provided turbine production data and participated in the measuring campaign.

Nomenclature

AEP	=	Annual Energy Production
v_u	=	wind speed at hub height level
v_m	=	measured wind speed
h_u	=	turbine's hub height
h_m	=	speed measurement height
α	=	wind profile exponent
z_0	=	roughness parameter
P	=	power available for the turbine's rotor
v	=	wind speed
z	=	height from ground level
D_r	=	rotor diameter
H_r	=	turbine's hub height
ρ	=	air density
R	=	correction parameter
P_{cor}	=	corrected power curve
P_{cer}	=	certified power curve (adjusted according the air density)
m	=	number of sector for wind direction

I. Introduction

IN Europe the wind energy industry was first developed in the nineties, mainly by northern countries. Since the late nineties interest in wind energy conversion systems (WECS) has been growing in other European countries, such as Italy, and knowledge of wind technology was transferred from Denmark, Germany and other such regions where WECS industry was already fully experimented. Designing techniques and methods to estimate wind energy potential that were developed for the typical northern European environment were applied, in some cases, to regions of a very different orographic nature.

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