ΑΡΙΣΤΟΤΕΛΕΙΟ ΠΑΝΕΠΙΣΤΗΜΙΟ ΘΕΣΣΑΛΟΝΙΚΗΣ
ΠΟΛΥΤΕΧΝΙΚΗ ΣΧΟΛΗ
ΤΜΗΜΑ ΠΟΛΙΤΙΚΩΝ ΜΗΧΑΝΙΚΩΝ
ΠΡΟΓΡΑΜΜΑ ΜΕΤΑΠΤΥΧΙΑΚΩΝΣΠΟΥΔΩΝ ΔΙΟΙΚΗΣΗΣ ΚΑΙ ΔΙΑΧΕΙΡΙΣΗΣ ΤΕΧΝΙΚΩΝ ΕΡΓΩΝ

ACADEMIC YEAR 2015 – 2016

TITLE OF DIPLOMA THESIS:

Energy efficiency optimization of off-shore wind parks with incomplete wind data

AUTHOR: Ioannis Panapakidis

ABSTRACT

Off-shore wind turbines installations are continually gathering the research interest since they are considered an efficient mechanism for covering the electrical needs of various isolated loads. The assessment of the energy potential of the off-shore wind turbines is a key factor that defines the successful implementation, operation and commercialization of the off-shore wind turbines technologies. The data used refer to many variables. The most important one is the wind speed. However, due to the metering failures or other factors the data may not present homogeneity due to incomplete or missing entries. This fact can lead to considerable limitations in the energy potential assessment and further, in the design of the off-shore wind park. The present diploma thesis focuses in the incomplete data handling. The data are gathered from a metering system that collects climatic and other variables within the Greek region. Frist of all, the very short wind speed forecasting task is investigated via models that are built on computational intelligent algorithms. A series of models is examined into two different prediction horizons. Next, a comparative analysis is held of clustering algorithms for grouping the daily wind speed curves. Each group is characterized by a typical curve. Through the typical curves, a descriptive model of the data is drawn. Clustering is the core for the development of a set of techniques for the incomplete data filling. Moreover, the optimal placement of a set of wind turbines to the formation of a wind park is a theme of investigation of the diploma thesis. Two metaheuristic optimization algorithms are examined and a novel one is proposed. After the definition of the optimal topology, the life cycle cost assessment takes place.

KEYWORDS

Wind farm layout optimization, Incomplete data, Wind speed forecasting, clustering, off-shore wind parks