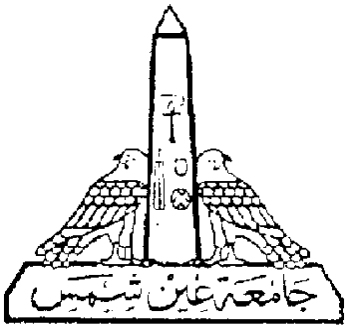

AIN SHAMS UNIVERSITY
FACULTY OF ENGINEERING
ELECTRICAL POWER AND MACHINES DEPT.

OPTIMUM LOAD MANAGEMENT STRATEGY FOR ELECTRIC POWER SYSTEM INCLUDING ELECTRIC GENERATION FROM WIND ENERGY

A Thesis
Submitted in partial fulfillment for the requirement of the
Degree of Master of Science in Electrical Engineering

By

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Agreement Report

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STATEMENT

This thesis is submitted to Ain Shams University for the degree of Master in Electrical Engineering.

The work included in this thesis was carried out by the author. No part of this thesis has been submitted for another degree or a qualification.

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Abstract

More growth in wind power generation, which was founded in Egypt in the coming years, the importance of wind power prediction has highlighted. However, wind power is very difficult for the modelling and forecasting. Despite the research in the field carried out, the prediction methods more efficient wind energy are sued. In this work two methods for predicting the generation of electricity from wind power are presented. The first method is the use the artificial neural network for predicting the energy production in the next database entry 10 minutes predicting wind speed meteorological authorities. The second method is the use of poly setting function for the wind power regression using the MATLAB program for the Zafarana site. For optimal management strategy generating capacity credit will be used in the future by the selected prediction methods for wind energy-Gabal El-Zeit wind farm site.

One of the most important economic benefits of wind energy is that it reduces the exposure of our economies to the volatility of fuel prices. This advantage is so great that simply could justify a higher proportion of wind energy in many countries. Governments need to correct market failures arising from external effects, since the costs and benefits of a home or a company buy or sells on the market of the costs and benefits for society are.

One of the main aims of this study is to compare between Zafarana site and Ras Ghareb site from an economic and technical point of view. It is generally known that there national plans for adding new units to the existing network of wind energy. The calculation for both locations performed lending capacity will be decisive for the final selection.

LIST OF ABBREVIATIONS

RE	Renewable Energy
NREA	New and Renewable Energy Authority
T.O.E	Ton oil equivalent
ANN	Artificial neural network
JAUES	Journal of Al Azhar university engineering sector
WPP	Wind Power Plant
ARIMA	Autoregressive Integrated Moving Average
PSO	Particle Swarm Optimization
MSE	Mean Squared Error
R	Regression
MAPE	Mean Absolute Percentage Error
SSE	Sum Squared Error
CC	Correlation Coefficients
SDE	Standard Deviation of Error
$\widehat{P}_h$	Predicted wind power at 10 minutes h
P_h	Actual wind power at 10 minutes h
$\overline{P}$	Average wind power
N	Number of predicted 10 minutes
e_h	Predicted error at 10 minutes
GB	Great Britain
ELCC	Effective Load Carrying Capability
LOLE	Loss Of Load Expectation
CF	Capacity Factor
CO2	Carbon Dioxide
S	Saved money when using wind techniques
F	Price of fuel per kWh using for generation of conventional turbines

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Chapter 1

Introduction

1.1. Introduction:

Power generation from renewable resources such as wind and solar power is fluctuated from hour to hour according to general weather conditions. This is different to fossil-fuel generators, which can normally be dispatched according to their operators' preferences.

As the use of wind generation technologies increases, the variable nature of this output will become a more important feature in power systems. In particular, it will have an impact on the amount of capacity that needs to be installed to meet peak system demand, and on the operating patterns of other generators.

The total installed capacity in Egypt in 2013/2014 is 32015 MW, while the wind power participates by 550 MW only (about 1.7%).

The real indicator of the wind participation in the generation of electricity in Egypt is the wind energy which is about 0.8 % of the generated energy in Egypt as shown in fig. (1-1).[1]

Renewable energy (RE) is the energy which brings from many resources as sunlight and wind which is naturally rejuvenation [2]. The present strategy target in Egypt is to satisfy twenty percentage of the electric energy demand from renewable energy resource by the year 2022,

including about twelve percentages from wind power, 8% from others RE sources.

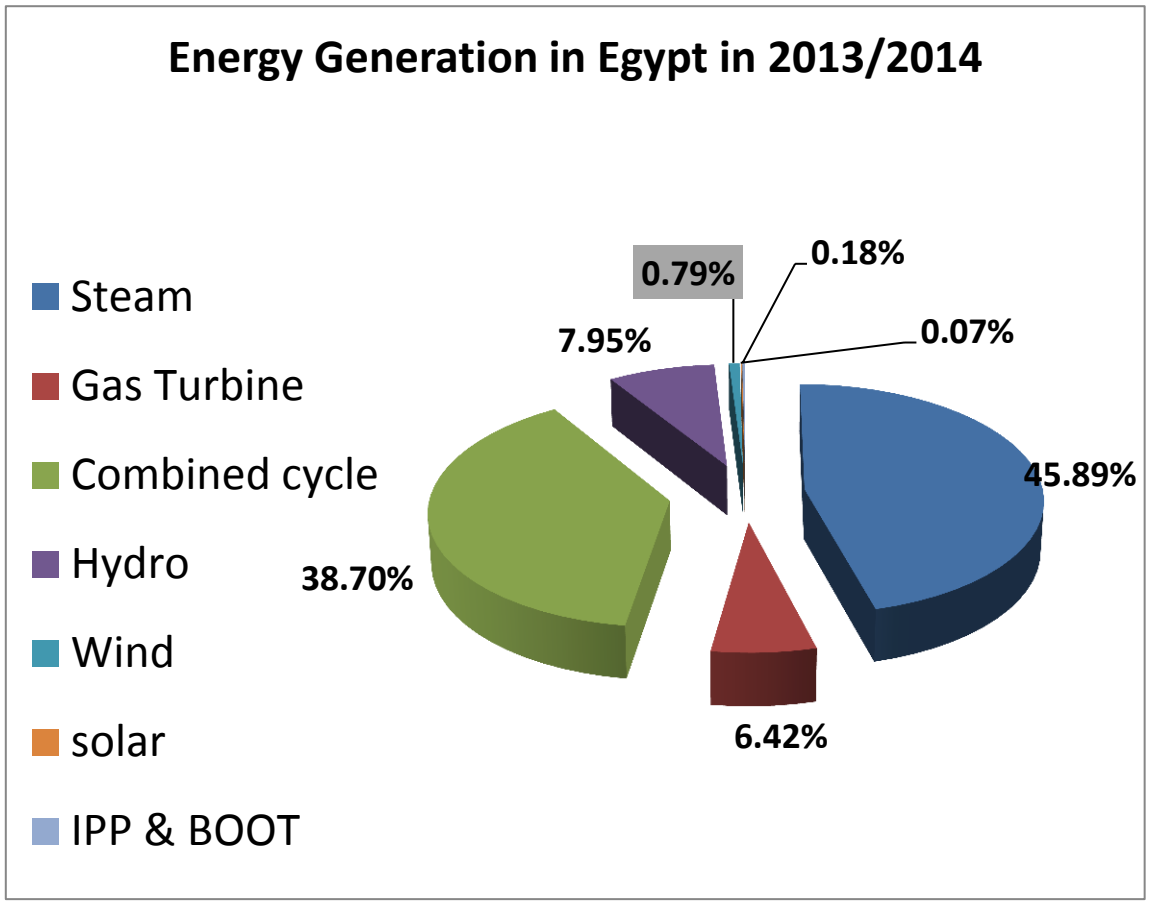

fig. (1-1) shows the percentage of the energy generation in Egypt including the percentage of wind energy.

Egypt has relied a resolution, is planned to cover twenty percentage of the generated electricity by renewable energy by 2022, including twelve percentage contributions from wind energy, depending mainly on about 7200 MW grid-connected wind farms.

An area of about 80 km^2 has been provided for NREA implement wind farms connected to the network. Site infrastructure has been finished, with high substation, buildings for workers, workshop, warehouse and high ways. In addition, an area of about 64 km^2 has been provided in the

west of the site as an extension to the same place. Since 2001 the number of large wind farms with a capacity of about 550 MW in cooperation with Germany, Denmark, Spain and Japan were founded.

The Zafarana wind farms are now working in complete interconnection with the unified electric grid in Egypt.

Generated Electricity is about 6.6 Billion kWh, Fuel Saving is about 1.4 million ton oil equivalent (T.O.E), and for reducing the emissions is about 3.3 million ton carbon dioxide .

The February 19, 2015 a contract was signed between New and Renewable Energy Authority (NREA) and the Spanish company Gamesa Olica on the west coast of the Gulf of signed to a wind power plant time to implement 220 MW in Gabal El Suez, with a total of around 220 million euros and the deadline for the application of this investment is approximately three years.

The project is established by the Japanese government through the Japanese International Cooperation Agency, about thirty eight billion Japanese yen with repayment period forty years, including a ten years donation period with interest rate of 0.3%.

This project is the largest wind power plant which NREA has been carried out. The energy generated from this project is expected to be around one billion kilowatt hours will save about two hundred and ten thousand T.O.E per year, and to achieve the reduction of about 550 000 ton of carbon dioxide per year.