

## 대형 풍력 농장에 대한 AC 전력시스템 모델링 개발

장수, 최준호, 손계도, 조정섭  
전남대학교 전기공학과

### The AC Power System Development For the Big Wind Farm

Shuai Zang, Joon-Ho Choi, Qitao Sun, Jung-Sub Cho  
Chonnam National University

**Abstract** - This paper will discuss the steps in building a wind farm and the modelling of AC power system for wind power generation. And take the JeJu island for an example, with its good wind power energy resource, the most important factor for a wind farm is a good power system interconnection to decrease the power loss including the transmission loss as less as possible. So in this paper, after the JEJU wind energy analysis, we will mainly discuss the development of the modelling on JEJU AC power system by using PSCAD. And also for using the real data of the wind power in the simulation, the modelling of the JeJu power system in 2011 will also be presented in this paper.

#### 1. Introduction

A wind farm is a collection of turbines (windmills) built in an area to provide electricity. Wind power, like solar power, is a renewable energy resource and an alternative to nonrenewable fossil fuels (oil, natural gas, coal). Engineers find new sources of energy.

Jeju is the largest tourist island in Korea, with its good wind energy source, located approximately 100km south of the mainland, and had a peak load of about 490MW in 2006, with an average growth rate 8.6% over the last 5 years. [1]

Jeju island has a sub-tropical oceanic climate with four distinct seasons. And Jeju island is historically famous of 'windy island' and the average yearly wind speed is 4.8 m/s. So it is good for building a wind farm.

#### 2. Steps in Building a Wind Farm

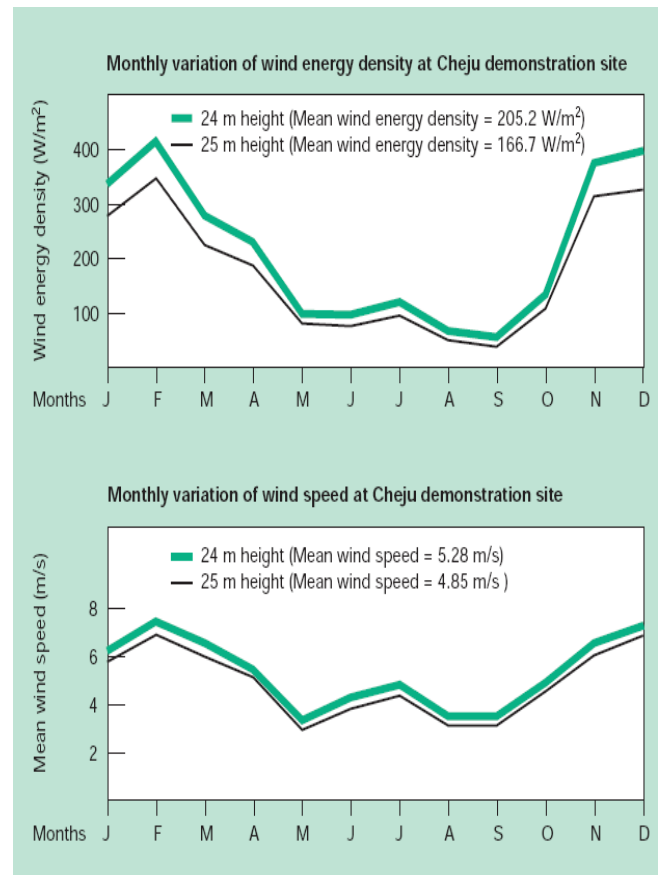
##### 2.1 Understand Your Wind Resource

The most important factor to consider in the construction of a wind energy facility is the site's wind resource. A site must have a minimum annual average wind speed in the neighborhood of 11-13 mph to even be considered. Local weather data available from airports and meteorological stations may provide some insight as to averages.

Jeju island is located in the northern Pacific off the southern tip of Korean Peninsula and 452 Km south of Seoul and consists of 60 annexed islands including 9 inhabited islands, which is the largest island in Korea and very famous of sightseeing site for just married couples in Korea and for foreign tourists.

The east and west side of Jeju Island have good wind

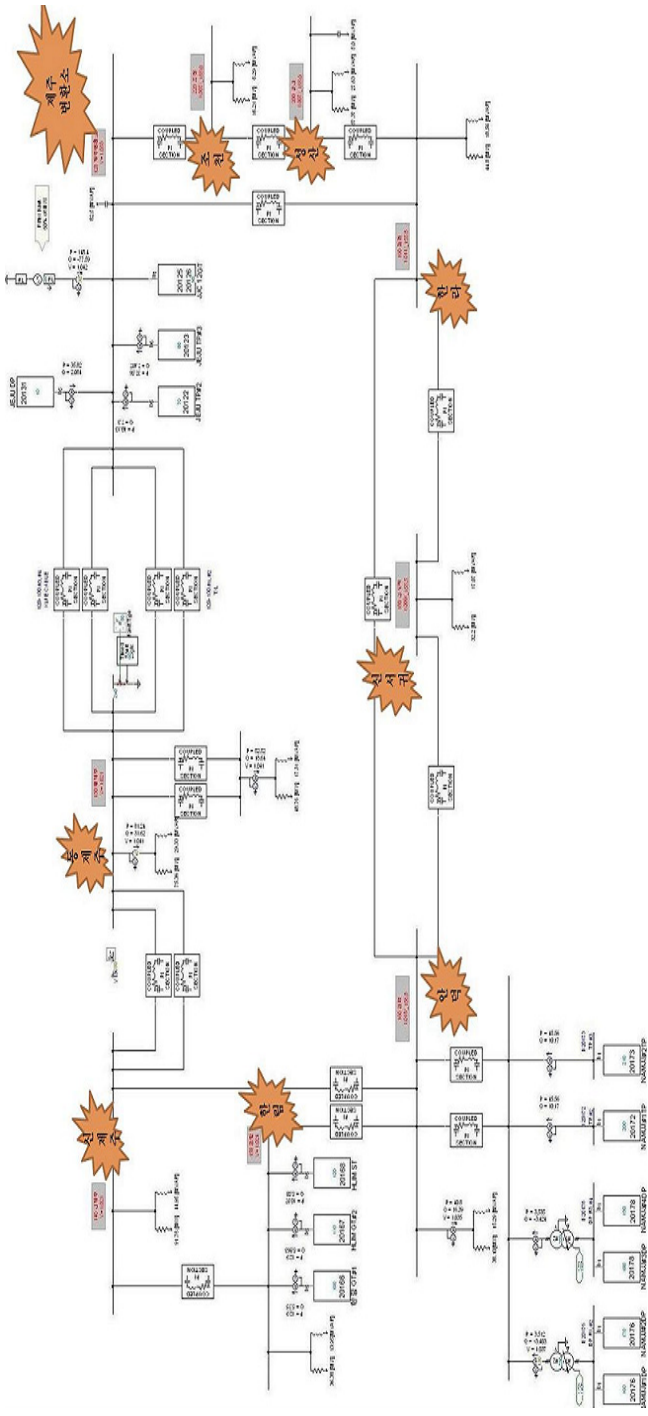
conditions and the average wind velocity is 6-7 m/s(Fig.1). Good wind conditions have led to an increased number of wind turbines.



<Fig.1> Wind Power Energy in JeJu Island

##### 2.2 The Modelling of The Power System

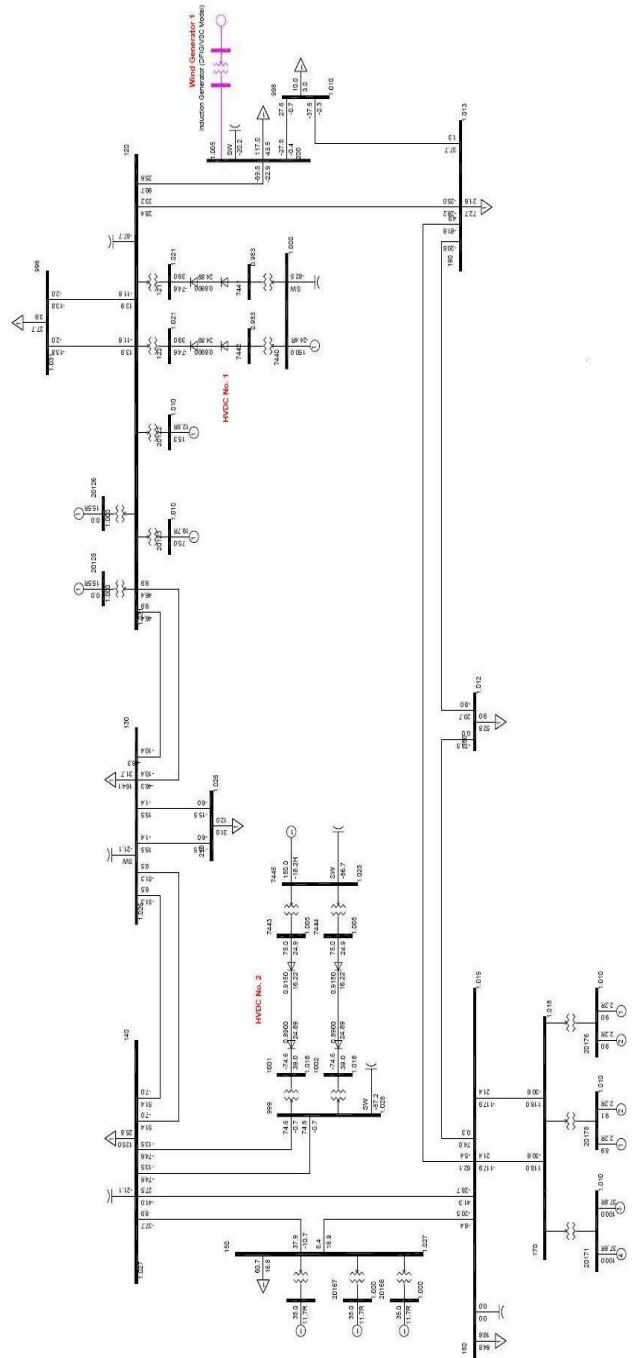
AC power system diagram of the Jeju - Haenam AC power system is shown in Fig.2. This modelling including the East-jeju, South-jeju, Hanlim and where there is abundance of wind energy to build large wind farms was interconnected as a big system and simulated by using PSCAD/EMTDC in this figure.



**<Fig.2> AC power system PSCAD-modelling diagram of the Jeju-Haenam[4]**

Also there are other factors for building a large wind farm, like the Determine Proximity to Existing Transmission Lines, Identify Reliable Power Purchaser or Market, Understand Wind Energy's Economics and so on, but can carry out the value of the power energy much better if we have a good modelling of the power system.

### 2.3 A Full Modelling connected with Wind Power Data



**<Fig.3> Jeju-Haenam Power Network in 2011**

For using the real data of the wind power in the simulation, the modelling of the JeJU power system in 2011 was shown in fig.3.

### 3. Conclusion

This paper mainly presents the steps and the to build the wind farm in JEJU and the modelling of the wide-area JEJU

AC power system by using PSCAD/EMTDC. And for Jeju island, located approximately 100km south of the mainland, is an area with good wind conditions and followed fig.3 the JEJU power network in 2011, it is expected to install a number of wind farms and the modelling of the JeJu power system will take a more important action on the JeJu wind power generation in the further years.

#### **[References]**

- [1] D. W. Park, "Impact of New Technology on the Korean Electricity Industry," IEEE Power Engineering Review, pp. 15-18, July 2001.
- [2] R. Karki, "Wind Power in Power System Planning," Electrical and Computer Engineering, Vol. 3, pp. 1511-1514, May 2004.
- [3] Kwang Y. Lee and Se Ho Kim, "Progress in Distributed Generation in Korea", IEEE, 2007
- [4] K. B. Song and S. H. Kim, "The Analysis of the Effects of the Renewable Energy on Power Systems and Operation Plans for Integrating Renewable Energy into Power Systems," KPX Report, Korea, October 2006.
- [5] Zang Shuai and Choi, Joon-Ho; "The PSCAD/EMTDC Modelling of JeJu AC Power System", KIIEE Annual Spring Conference, May 2008.