

Compensation for the feed-in fluctuations of offshore wind parks by biogas plants

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Summary:

The golden times of fossil energy supply are coming to an end. A growing ecological awareness is spreading in the heads of people from industrial countries. The use of renewable energy is more and more accepted. But before renewable energy can be used more intensely, some problems have to be solved. One of them has to do with balancing the natural feed-in fluctuations of volatile energy sources like the wind or the sun. Especially the offshore wind energy plants, that are planned for the future and that will be combined to offshore wind farms, need an efficient and, even more important, environmentally friendly solution. For this problem the biogas plant can be a solution, as the energy supply of this technology can be realized according to requirements. In how far these energy plants can compensate the energy fluctuations of the farms shall be shown in this paper.

Full Description:

In times of globalization and fast growing demand for energy, a secure, independent and ecological energy supply is getting more and more important for the economic success of an industrial nation. Energy prices go up, amongst other things due to a shortage of fossil resources. This leads to disadvantages in national competition, not only for the energy-intensive industries of a country. The increase of emissions that are harmful for the environment and the heating-up of the atmosphere makes the possibility of dramatic consequences for mankind and nature more probable. This is why concepts are needed that make a secure, affordable and climate friendly energy supply possible. At the German energy summit 2007 security of supply and energy efficiency were the central topics. The German Presidency of European Council decided that the European Union has to enter a clear and independent commitment. It has to increase the renewable energy by 20% compared with the base year 1990. This is why the endeavours of the German Federal Government shall lead to installing 25 GW Offshore wind energy power in German territorial waters until the year 2020.

This leads to the question, in how far wind energy can be embedded efficiently into the interlinked German power system, respectively how the offshore wind parks can be embedded into the conventional system of generating stations. The wind parks have a built-in power of more than 400MW. So, with regard to built-in power, they correspond to a conventional generating unit and can be called offshore wind parks. The main problem of using wind energy lies in its volatile character (Fig.1). Sometimes fluctuations of feeding-in appear and they are sometimes very pronounced, so that they cause problems for the grid stability. Even with the help of weather forecasts a volatility of this kind of regenerative energy supply cannot be determined clearly. To guarantee a reliable energy supply the energy fluctuations have to be minimized. There are only a few types of generating stations that can assure an immediate control. Hydroelectric and gas-fired power plants are of that type. For the first ones an appropriate location is a basic prerequisite. In Germany however, there are only few appropriate locations and most of them are used already. There are no such restrictions for gas-fired power plants. But their use is very cost-intensive, which puts them far back in the current merit-order. Biogas plants could be an alternative. If they are equipped with fast adjustable mi-

cro-gas turbines, they can simulate the character of a gas-fired power station. Another advantage is that the required raw material can be cultivated locally and cost-efficiently. The German coasts do not only offer an appropriate location for the biogas plants because of their agricultural coinage. In that way they can be connected to the same point of delivery the offshore wind parks are connected to.

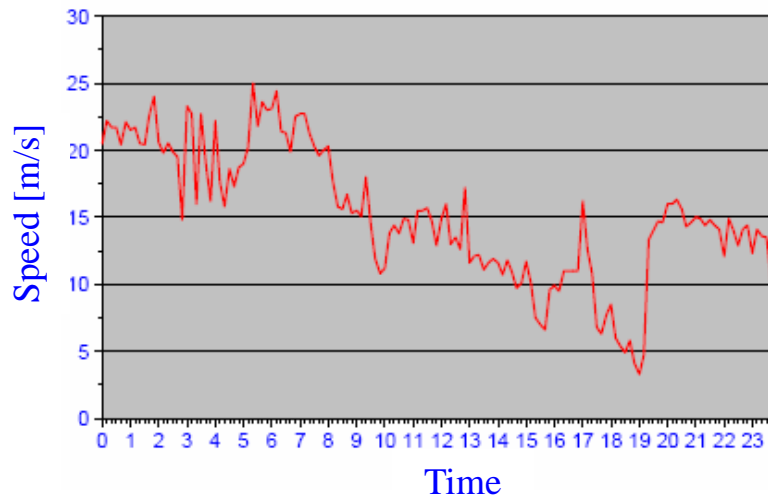


Fig. 1: wind speed (day)

In the paper the possibility will be shown to decrease the feed-in fluctuations of offshore wind parks by the help of biogas plants. A model that is based on the current research into an offshore wind park, the feed-in fluctuations are simulated. They do not only appear because of changes in wind speed. They do also appear because of variable shadowing effects of the turbines, caused by changes of wind direction.

There is no need to revert back to time series modeling or interpolation concerning input data. The advantage of this model lies in the use of real measured wind velocities and wind directions on hub height of future wind energy plants. By that, mistakes in time series modeling and insecurities in adjustments of heights do not have to be considered.

In addition to the wind park model, the electric functionality of a biogas plant in combination with a micro-gas turbine will be modeled. The possibilities of adjustment control of biogas plants will be simulated. This will be done with regard to the input data that is interesting for the electric output data and its coherences. By connecting an offshore wind park model to a biogas plant, investigations can be carried out. These investigations will deal with the potential of compensation of biogas plants for the feed-in fluctuations of offshore wind parks. An investigation of economic potential is possible, too. The results of these examinations shall be presented in this paper.