

A study of photovoltaics and of combining solar power with an existing wind power plant

This project was conducted to give an insight in to how existing grid and power production infrastructure can be utilized by building a solar power plant and connecting it to an existing wind power plant. Different methods of installing and orienting solar modules were also studied as a complement to this.

There are multiple reasons to why the subject of hybrid electricity generation systems is important for future power systems. By choosing locations with existing power equipment such as transformers or switchgear, investors can save money on the grid connection costs which are generally high. Not only is a new grid connection expensive, but it also involves a long and complicated process. This means it could also save a project a lot of time and work. In addition to these things, the intermittent nature of power sources such as wind and solar leave a big gap in the power supply from the grid connection equipment it is connected to. This is where the negative correlation from these two power sources can prove useful. Solar power generates most of its electricity during the summer months, whereas wind power generates more during the winter months. Combining the two and connecting them to the same grid connection point will increase the utility of the existing equipment which is also a big positive in terms of saving materials.

There were two main parts to this project; a study on different solar panel installations and a hybrid system analysis. Six different panel installation/orientation setups were evaluated and compared based on the their electricity production and profitability. The results show that installing the solar panels with a 30 degree tilt and orienting them to the south is the most cost effective option for the chosen location given that the space between the panels is 10 m. Large row spaces reduces the risk for panel shading, which reduces the overall efficiency of the system, but also allows the space in between the panels to be used for agricultural purposes. This installation method was then used for the subsequent hybrid system simulations. The hybrid analysis was set up in a way where the profitability of building a standalone grid connected solar power plant, including grid connection cost, was compared to building a solar power plant and connecting it to an existing grid connection. Here the grid connection capacity and the wind power would limit how much of the solar power that could be sent through to the grid. Results showed that if you add a solar power plant with up to 75% of the installed power of the wind and capacity of the grid connection, it will be more profitable than building a solar power plant of the same size from the ground up. This is mainly because of the saved money from grid connection costs. In the future hopefully more of the existing grid connection points and transformers will be utilized in this fashion, as it will reduce the need for building new ones and still leave you a profitable investment.