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Masters of Science

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Optimization of Hybrid Systems

Background

- To encourage the use of renewable energy, it is necessary to provide tools to optimize both the technical and economical aspects of the energy sources.
- Hybrid power plants utilize a combination of two different technologies to produce power. In these power plants, at least one component is a renewable source of energy such as PV or wind.
- One of the benefits of hybrid energy systems is that it provides a method to use renewable energy systems while still ensuring the security of constant power supply through a mix of generation methods. It often also includes a storage system such as batteries, making it a more self-sufficient system.
- There are several challenges associated with hybrid systems, the foremost being the economical disadvantage due to high installation cost. Furthermore, renewable energy systems often require storage units, such as batteries, which require more research and improvement in technology.

The following figures demonstrate a simplified example:

- Figure 1 shows the output power from the wind and PV system.
- Figure 2 illustrates the summation of the two outputs.
- This combined output is taken and the ideal amount to be stored, to develop the optimum generation profile is calculated, as shown in Figure 3.

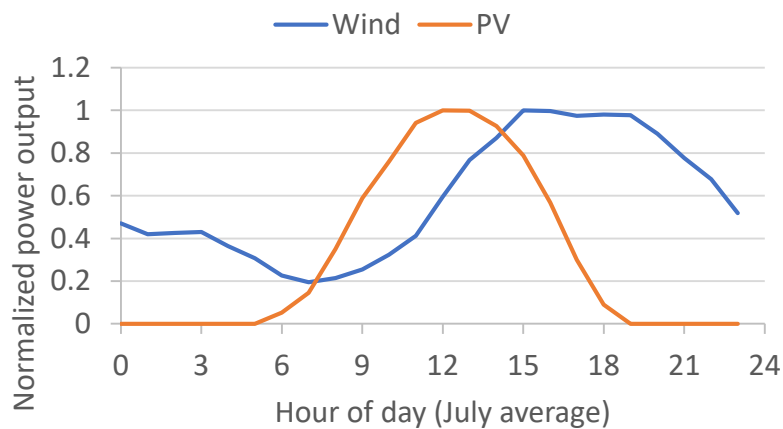


Figure 1

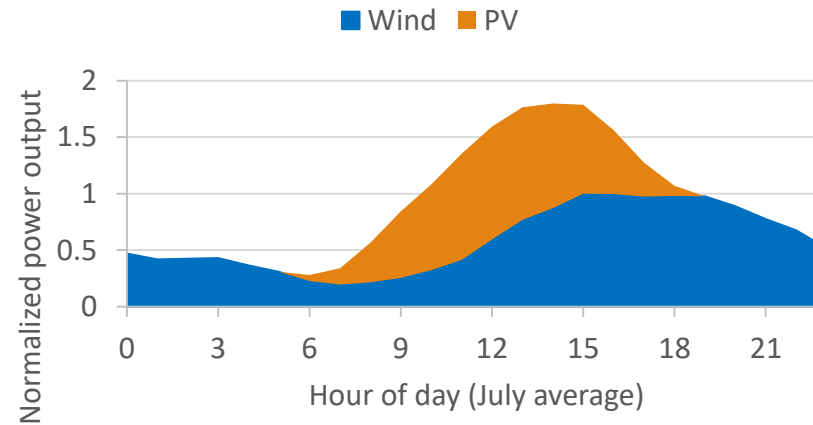


Figure 2

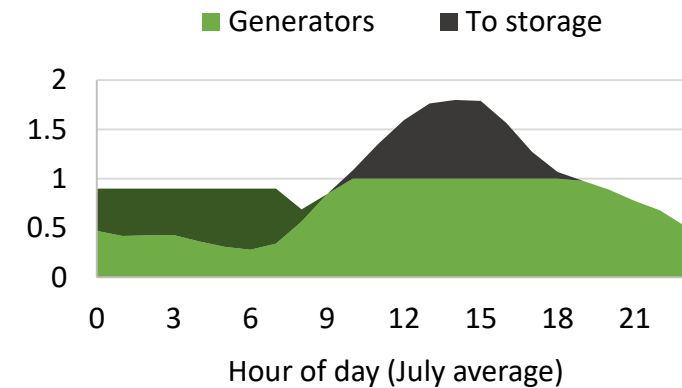


Figure 3

Objective

- Create a modeling tool that optimizes electricity generation in hybrid renewable systems.
- Consider both the technical and economical aspects of the energy sources being modeled.
- Solve for several factors, such as amount to be stored, in order to achieve a better generation profile.

Methodology

- The objective of this project is to provide a program, or the tools required to optimize various parameters, such as time of use, of hybrid renewable energy systems.
- This is being done using linear optimization solvers.
- SAM is being used as a starting point from where data is acquired and used as an input for further optimization.