

Curtis Sirkoch

CHENE3810 Final Assessment

Renewable Energy

A hopeful system for greening our energy system is a combination of solar photovoltaic energy, wind energy, and grid storage. While solar and wind energy production have proven to be commercially viable in low amounts of grid penetration, further adoption of these technologies has been inhibited by concerns of cost and grid stability. Variability in solar and wind energy supply results in a need to invest in enough grid storage to obtain a desired grid stability. The relation between renewable energy penetration and the amount of storage required is non-trivial and many papers are devoted to modelling it both technologically and economically.^{1,2}

A common metric for evaluating the viability of an energy technology is the Levelized Cost of Energy (LCOE). Its convenience comes from its high-level generalization of many technical factors which affect cost and its ability to compare viability across different technologies. For instance, the LCOE encompasses all the efficiency losses explored in the Efficiency and Optimization Solar to Fuel Cell lab and could be used to explore the economic differences between fuel cells and batteries.

While the lab explored the many factors which affect the efficiencies of solar and wind energy production, the main challenge facing the widespread adoption of these technologies is finding a scalable solution to grid storage. The many technologies being considered include batteries (Li+ ion, Flow batteries, and other chemistries), mechanical (compressed air, pumped hydro, flywheels, and hauling giant blocks of concrete into the air), fuel cells, and thermal energy storage. Each one of these technologies carries with it a wealth of literature concerning their variety of applications and advantages at scale. Regardless, it is imperative that tomorrow's engineers understand the limits of a technology, informed by sound technical and economic analytic skills, and above all, keep an open mind toward the many potential solution out there and yet to come.

Bibliography

1. <https://www.nature.com/articles/nclimate3045>
2. <https://www.pnas.org/content/112/49/15060/tab-figures-data>