Energy storage for peak shaving lebanon

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The current status of the Lebanese power system is characterized by a structural power supply deficit and transmission and distribution inefficiencies. In this chapter, the Lebanese power system is used as a case in point to showcase the importance of shifting the foundations of conventional thinking in power system planning into a new paradigm where renewable energy is adopted as priority choice.

The technical and economic feasibility of wind farms, solar PV, and battery energy storage systems is studied. Simulations are run using Homer pro to optimize for the lowest cost of electricity. Results show that incorporating utility-scale renewable energy systems and battery energy storage can decrease the overall levelized cost of electricity (LCOE) to $c7/kWh. Furthermore, without the integration of considerable storage capacity, an economic limit of approximately 20-25% renewable energy penetration is reached.

Sensitivity analysis is undertaken while adopting various values for the cost of natural gas and internalizing the social cost of carbon. Results confirmed a positive correlation between the cost of carbon and the price of natural gas on the one hand and system renewable energy fraction on the other hand. Introducing demand side management and increased grid flexibility also showed a high level of sensitivity to both system LCOE and the renewable energy fraction.

Based on these results, the research strongly recommends that power system planning in the Middle East integrates modeling of renewable energy systems and the stacked benefits of utility-scale storage with the objective to achieve the highest combined technical, economic, and environmental benefits.

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