The Solar Duck Curve and Sustainable Storage Options: A Policy Recommendation
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Devon Rood

Abstract
Before the rise in renewable energy, few people considered the consequences of adding large amounts of intermittent power onto the grid. As renewable energy has become more prevalent, utility companies must adapt their business practices to accommodate these unique sources of power. This is leading to challenges on how best to manage a grid with large amounts of renewable power.

Arizona Public Service (APS), the largest electricity provider in the state of Arizona, has more than 70,000 distributed solar customers on their grid and the number of solar customers increases every day. With this increase in distributed solar customers comes the solar duck curve—the phenomenon whereby solar produces energy during times of low demand. However, with the use of storage, the duck curve problem may be mitigated.

This project examines the sustainability of three storage options: pumped hydro energy storage, compressed air energy storage, and lithium-ion batteries. Using several sustainability indicators, this project makes a policy recommendation to APS on the most sustainable choice for large-scale energy storage.

This project found that compressed air energy storage was the most sustainable option for APS. This considered the impacts of compressed air on the environment, communities, and the costs of this storage option. One important aspect to acknowledge regarding this technology is that in its current form, it does emit some carbon emissions. However, the carbon emissions may have less of an impact if this storage facility can allow APS to use its renewable energy assets most efficiently and continue to use energy from Palo Verde, the nuclear facility in Arizona.