GAME THEORY IN THE ENERGY STORAGE MARKET

Magdy Salama

Energy storage systems like batteries, supercapacitors and flywheels play an important role in the world of renewables. When the sun isn't shining or the wind isn't blowing, these devices ensure customers have reliable power.

This has sparked interest in privately owned energy storage hubs that could sell power to customers as they need it. To find out how this might play out in the marketplace, WISE researcher Magdy Salama and his colleagues applied game theory, a method that models competition, interdependence, conflicts of interest and real-life decision making.

Their study examined how interactions between an energy hub owner and a collection of customers — electric grids, residential customers and industrial customers — might play out under two different approaches.

One approach was co-operative, aiming to maximize the benefits for all players using a regret-matching algorithm. The other was non-cooperative, using an ascending price-clinching auction where each player acted to maximize their own gains.

Customers submitted their predicted needs 24 hours in advance. Then a "game" was played each hour to determine how much the energy hub sold to each one, based on their willingness to pay or to reduce their energy needs.

The simulations revealed very different outcomes. The cooperative game yielded lower profits for the energy hub owner. However, the other players all benefited. The non-cooperative game was also shown to be a reasonable model, making the energy available to the player who values it most.

The researchers conclude that both approaches have the potential to build a strong, sustainable energy storage market.

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