The Cobweb Effect in Balancing Markets with Demand Response

Integration of renewable energy sources (RES) like wind into the power system is a high priority in many countries, but it becomes increasingly difficult as renewables reach a significant share of generation. Demand response (DR) can potentially mitigate some of these difficulties, but the best way to control and integrate DR into the power system remains an open question. Integration into existing electricity markets is one option, but dynamic pricing with DR has been observed to be unstable, resulting in oscillations in supply and demand. This so-called Cobweb effect is presented here using the market structure and measurements from the EcoGrid EU demonstration, where five minute electricity pricing is sent to 1900 houses. A new tool for quantifying volatility is presented, and the causes for volatility are investigated. A key outcome of this study shows that increases in social welfare due to DR appear to be limited by the cost of volatility in existing market structures.