

Farhad Samadi Gazijahani and Javad Salehi, 2019, IGDT based Complementarity Approach for Dealing with Strategic Decision Making of Price Maker VPP Considering Demand Flexibility, *IEEE Transactions on Industrial Informatics*.

Abstract This paper develops a novel bi-level decision-making framework for a price-maker virtual power plant (VPP) to participate in both day-ahead and balancing oligopoly markets considering multiple forward contracts. In principle, VPP operator with having the possession of financial transmission rights, can manage its financial risk through trading electricity among various markets such as centralized pool and contract markets aimed at maximizing its own profit and minimizing the associated risk. Besides, VPP operator will be able to optimize its procurement expenditures by incentivizing flexible demands proportion to different electricity tariffs. In the proposed bi-level model, the VPP aggregator strives to maximize its own profit at the upper level while ISO seeks to clear both markets at the lower levels with an eye to maximizing social welfare. Each lower level is then replaced by its complementarity slackness conditions and consequently is recast as mathematical program with equilibrium constraints that can be solved using off-the-shelf software packages. Furthermore, the uncertainty pertaining to renewables has been envisaged through information gap decision theory resulting in robustness/opportunity function to deal with self-scheduling of VPP. This paper ends up with an illustrative case study through performing after-the-fact actual market data to verify the applicability of the model.