

# Impact of Rewarding Strategy and Energy Price Scheme on Mobilization the Flexibility of Residential End-users



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## Context

- Flexibility of the residential end-users can be traded as market products for better management of the power system.
- The rewarding strategy defined by the aggregator and energy price scheme selected by the end-user have impact on the mobilization of the end-users' flexibility.

## Research Questions and Objectives

- How does the aggregator's rewarding strategy affect the flexibility provision by the end-users?
- How does the end-users' energy price scheme influence their responsiveness to the aggregator's rewarding?
- The objective is to characterize the responsiveness of the end-users towards the aggregator's rewarding strategy under different energy price schemes and reward values.**

## Methodology

- MILP optimization model is proposed for the aggregator to characterize the end-users' responsiveness to reward signals and the corresponding flexibility profiles.
- The optimization model aims to maximize the aggregator's profit and find the optimal bids to be submitted to the market.
- The impact of rewarding strategy on flexibility provision is assessed through different rewarding scenarios.
- Different energy price schemes are applied to analyze their impact on the end-users' responsiveness to the aggregator's rewards.

## Results

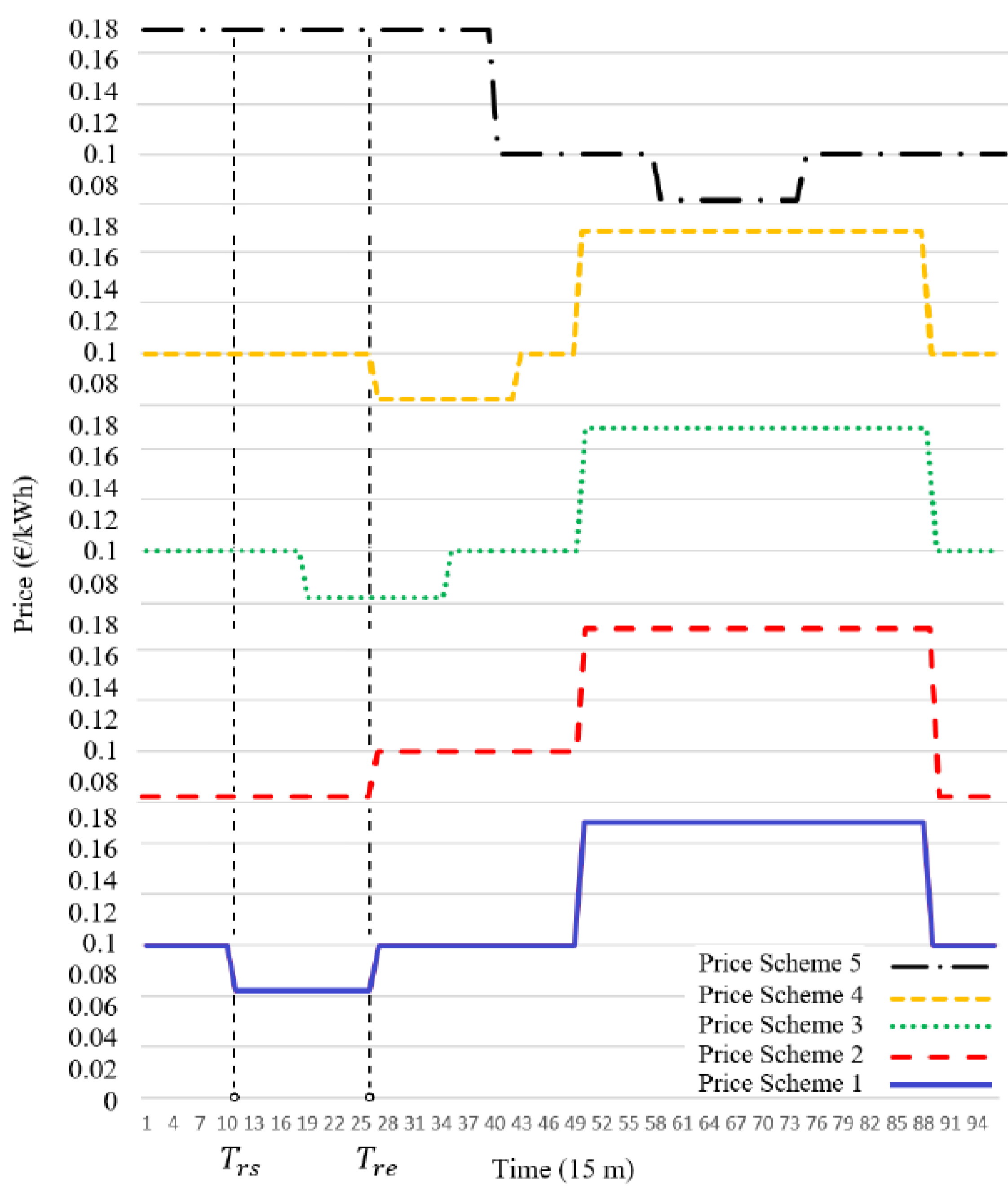


Figure 1: Energy price schemes

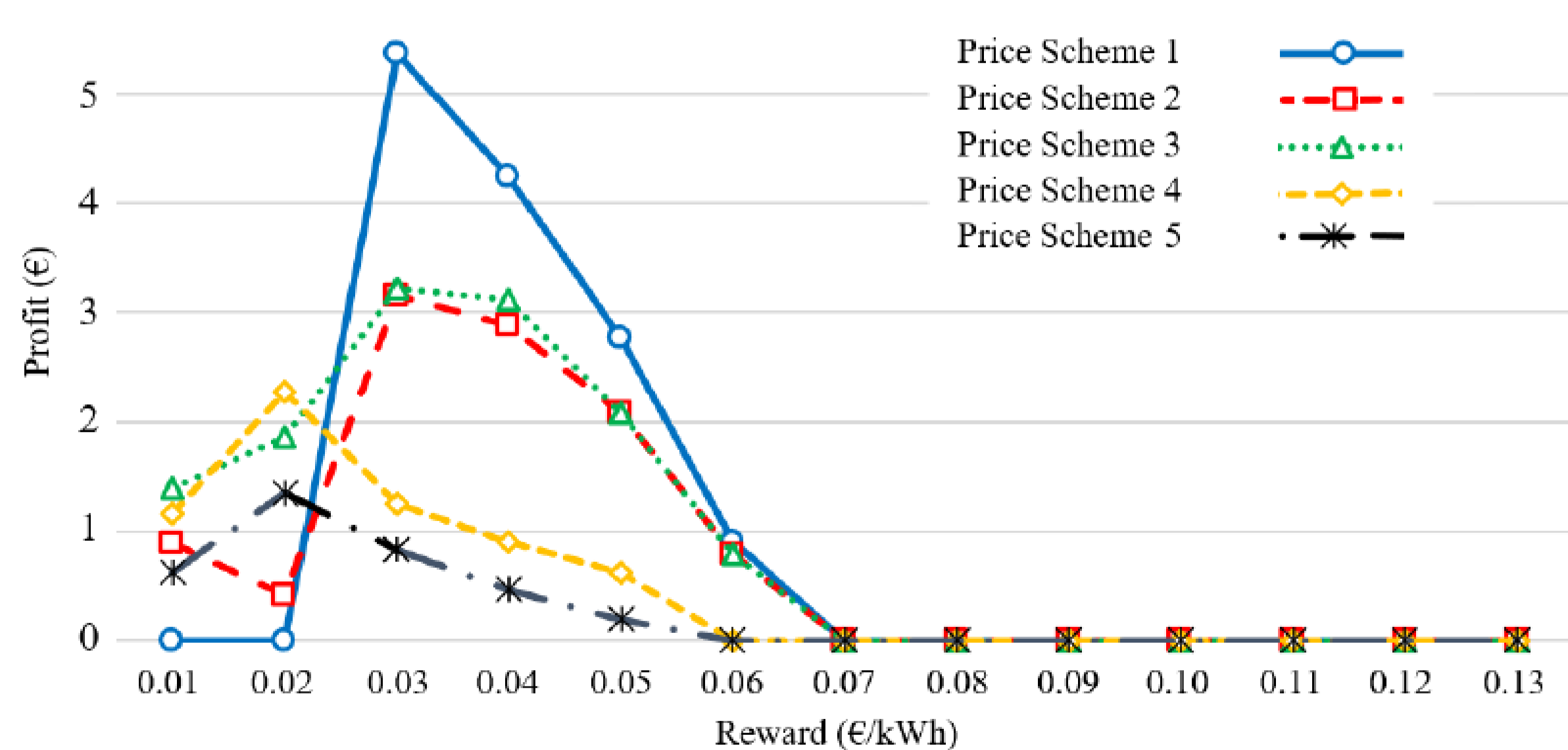


Figure 2: Aggregator's profit obtained from optimal aggregation of the flexibility of 20 different end-users associated with different reward values and energy price schemes (rewarding scenario 1: Incentives for selected end-users)

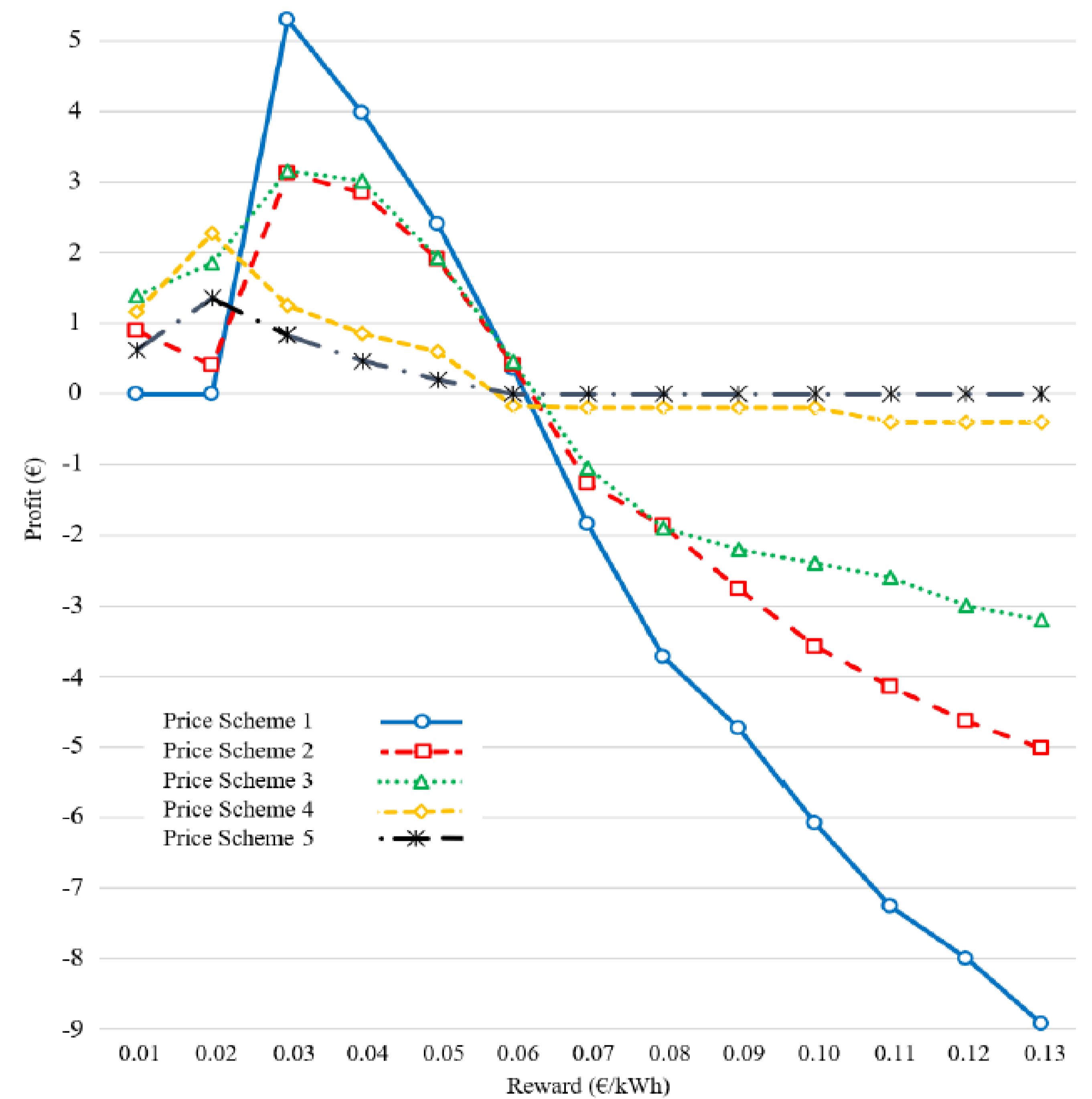


Figure 3: Aggregator's profit obtained from optimal aggregation of the flexibility of 20 different end-users associated with different reward values and energy price schemes (rewarding scenario 2: Incentives for all)

## Conclusion and Future Work

It is concluded that the proposed methodology could shed light on the impact of the energy price scheme on mobilizing the flexibility of residential end-users and aggregator's profit. Consideration of other aspects such as the market timeframe and elasticity of the end-user's responsiveness is relevant to offer further insights for the aggregator's decision-making process

## Publications

- V. Rasouli, Á. Gomes, and C. H. Antunes, "An Optimization Model to Characterize the Aggregated Flexibility Responsiveness of Residential End-users", *International Journal of Electrical Power & Energy Systems*, Vol. 144, January 2023.
- V. Rasouli, Á. Gomes, and C. H. Antunes, "Characterization of Aggregated Demand-side Flexibility of Small Consumers", *SEST Conference*, September 2020.
- C. H. Antunes, V. Rasouli, M. J. Alves, Á. Gomes, J. J. Costa, and A. Gaspar, "A Discussion of Mixed Integer Linear Programming Models of Thermostatic Loads in Demand Response", *Advances in Energy System Optimization*, Springer, 2020.

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