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Power Systems Laboratory

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Opportunities and requirements for small-to-medium scale energy flexibility management solutions in various power market regimes

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Abstract

Acknowledgements

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2.2.1 Objective Function

$$\underset{d_t^{DA}, c_t^{DA}, d_t^{RT}, c_T^{RT}, r_t}{\text{maximize}} \quad \sum_{t}^{t \in T} \text{Revenue}_\text{t}$$
$$= [p_t^{DA}(d_t^{DA} - c_t^{DA}) + p_t^{RT}(d_t^{RT} - c_t^{RT}) + (p_t^r + p_t^{RU}\delta_t^{RU} - p_t^{RD}\delta_t^{RD})r_t]\Delta t$$

Aggregators/ Neural Traders - Arbitrage

$$Revenue_t = p_t * (d_t - c_t) * \Delta t$$

Generators - Increased revenue

$$Revenue_t = [p_t * (g_t + d_t - c_t) - p_t * g_t] * \Delta t = p_t * (d_t - c_t) * \Delta t$$

Retailer - Reduced cost

$$Revenue_t = [p_t * l_t - p_t * (l_t - d_t + c_t)] * \Delta t = p_t * (d_t - c_t) * \Delta t$$

2.2.2 Constraints

Energy Storage Systems (ES)

subject to

$$
\begin{aligned}
& S_t = \eta_s S_{t-1} + [\eta_c(c_t^{DA} + c_t^{RT} + \delta_t^{RD} r_t) - \eta_d(d_t^{DA} + d_t^{RT} + \delta_t^{RU} r_t)]\Delta t \\
& d_t^{DA} + d_t^{RT} + \delta_t^{RU} r_t \leq d_t^{max} \\
& c_t^{DA} + c_t^{RT} + \delta_t^{RD} r_t \leq c_t^{max} \\
& \delta_r r_t \Delta t \leq S_t \leq S_t^{max} - \delta_r r_t \Delta t \\
& d_t^{DA}, c_t^{DA}, d_t^{RT}, c_T^{RT}, r_t \geq 0 \\
& \forall t \in [1, 2, ..., T]
\end{aligned}
$$

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