Docket #: S17-256

Automatic Power Exchange (APEX) for Distributed Energy Resource Networks

Stanford researchers have developed a low-cost, efficient, and reliable market platform system to monetize underutilized distribution system assets called Automatic Power Exchange (APEX). This scalable market platform allows power distribution system participants, including renewable energy sources such as solar and wind, to efficiently trade energy and services using a market-based mechanism that includes uncertainties to control the system dynamics. APEX enables flexible engagement and pricing terms to be settled between supply and demand using open-gate forward market design, which hedges against uncertainties, efficient matching algorithms and flexible buy orders. APEX can also reduce electricity bills for users and help utility companies recover their long-term infrastructure investments.

Figure

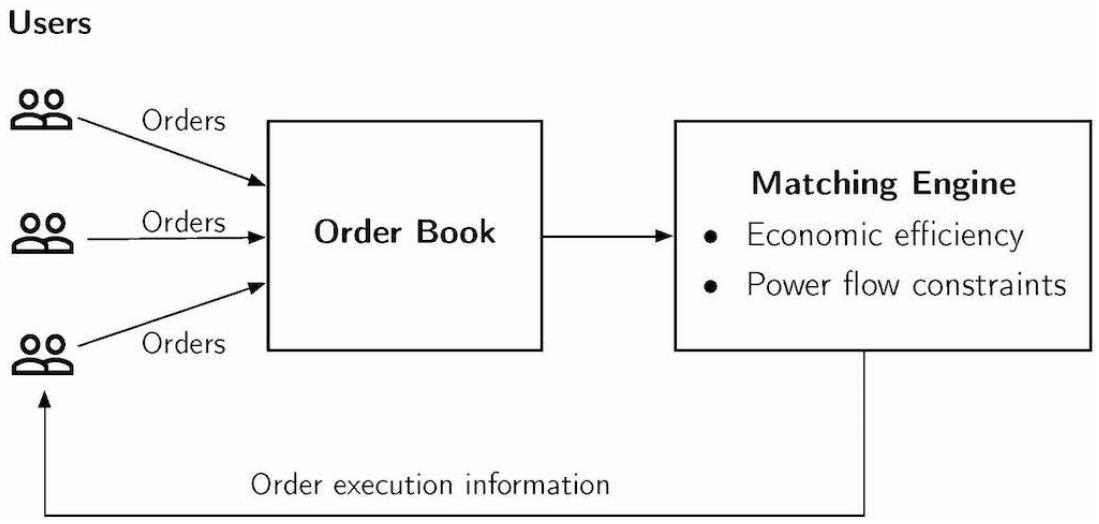

Figure description - Trading Process in APEX

Stage of Research:

- Conceptual framework with simulations

Applications

- **Power Exchange Platform** matching energy providers and users
- Can be used by large regulated utility companies, non-regulated generation (NRG) companies and third-party owned distributed generation sites

Advantages

- **Low cost, efficient and reliable**
- **Scalable** market platform
- **Open- gate forward market design** incorporates uncertainty from variable resources
- **Explicit flexibility market** schedules flexible user buy orders
- **Uses efficient matching algorithm and software implementation**
- **Can include other energy providers** such as solar and wind in the marketplace
- **Maximizes revenues for providers and reduces electricity bills for consumers**
- **Free market approach** - electricity consumers choose whom to trade with and what type of electricity to buy whereas in current markets, users buy all electricity from local utility companies

Publications

- Qin, Junjie, Jonathan Mether, Jhi-Young Joo, Ram Rajagopal, Kameshwar Poolla, and Pravin Varaiya. "Automatic Power Exchange for Distributed Energy Resource Networks: Flexibility Scheduling and Pricing." In 2018 IEEE Conference on Decision and Control (CDC), pp. 1572-1579. IEEE, 2018.

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