

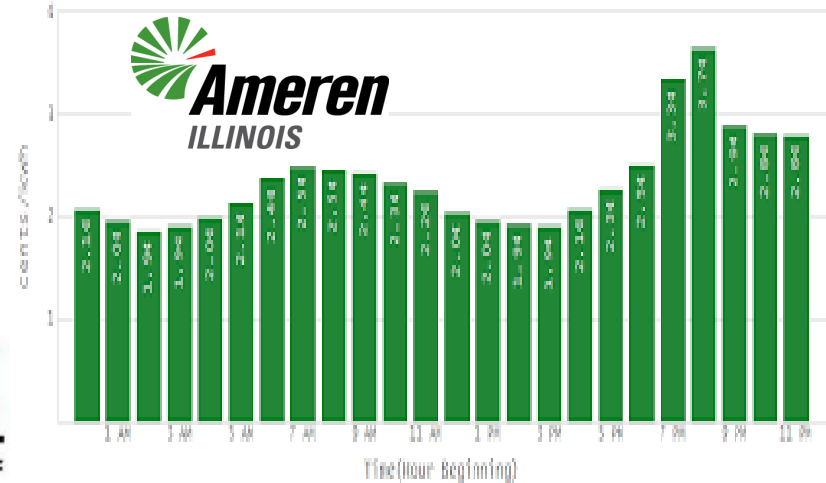
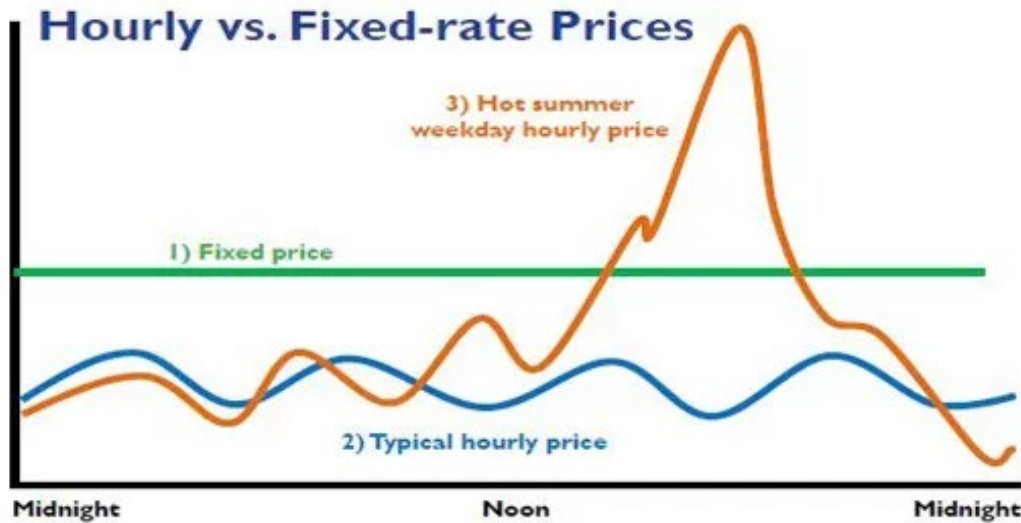
Learning-aided Equitable Time-varying Pricing Tariff Design

Bolun Xu

*Assistant Professor, Earth and Environmental Engineering
Columbia University*

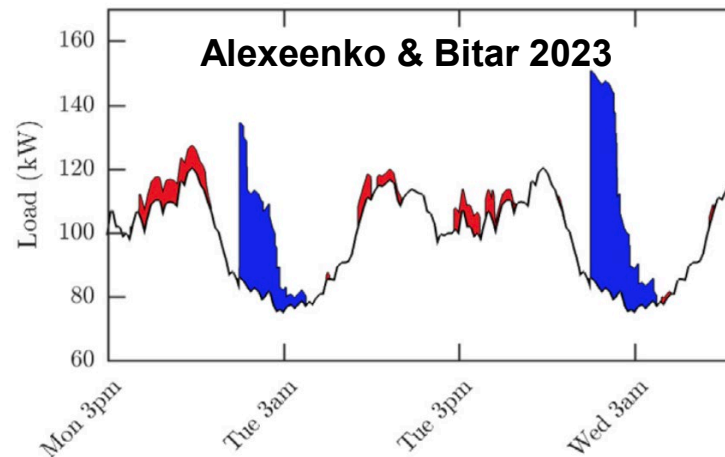
Time-varying Pricing Tariff

- Incentivize demand response by updating utility prices every hourly based on grid conditions
- Prices primarily design based on wholesale market prices



Challenges of Time-varying Pricing Tariff

- Transmission vs. Distribution
- Synchronization effects – what if everyone respond at the same time?
- Equity – not everyone can respond



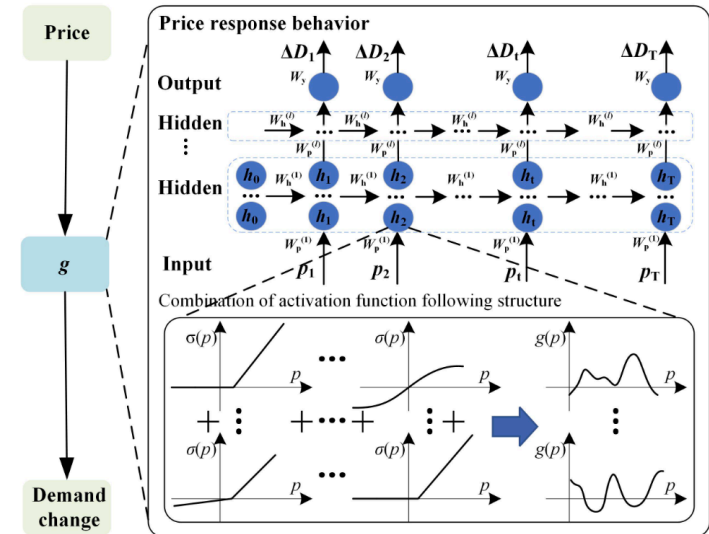
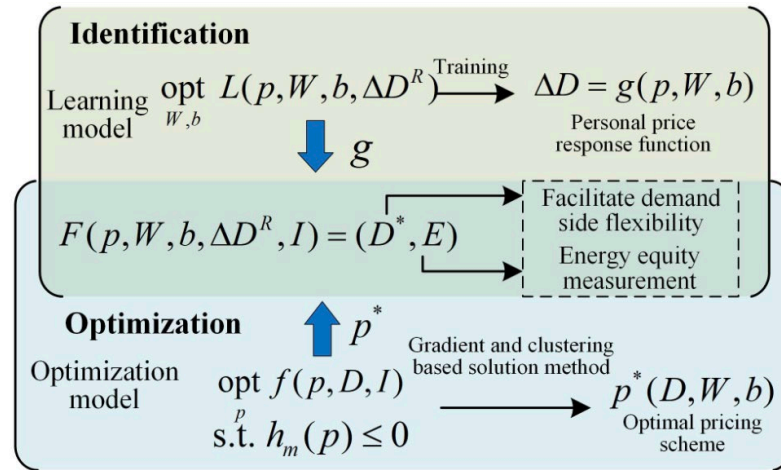
His Lights Stayed on During Texas' Storm. Now He Owes \$16,752.

After a public outcry from people like Scott Willoughby, whose exorbitant electric bill is soon due, Gov. Greg Abbott said lawmakers should ensure Texans “do not get stuck with skyrocketing energy bills” caused by the storm.

NYT March 1st, 2021

Learning-aided Time-varying Tariff Design

- Use RNN to model income-aggregated consumer response behaviors
- Embed RNN in tariff design with energy burden objectives and distribution grid peak shaving targets



Ensure response performance while reducing energy burden

- Simulate case study based on real-world data
- Achieve similar total demand responsiveness
- Reduce energy burden on low-income consumers

