

MODERNIZING COMMERCIAL RATE DESIGN TO ALIGN THE PRIVATE BENEFITS OF DISTRIBUTED ENERGY RESOURCES WITH SYSTEM AND SOCIAL WELFARE

Student name: Matthew Haley

ABSTRACT

The adoption of Distributed Energy Resources (DER) – such as battery energy storage and rooftop - solar are revolutionizing the topology and operation of the electric grid. When paired with smart control and communication technologies, DERs transform traditional electricity customers into potential providers of (possibly zero-emission) energy and grid services. Electricity rates - the policies that govern the retail use cases for these technologies – however, have lagged behind technological advances of the modern grid. Retail rates designed in a less technically complex era – such as demand charges – do not send price signals that align customer behavior with either grid or social benefits.

In this presentation I investigate the retail rate incentives for the commercial segment of energy customers in Texas. Texas provides an interesting test case for commercial investment in energy storage for two reasons: first, low energy prices driven by cost declines in renewables and natural gas has caused commercial and industrial energy use in Texas to grow compared to other states, second, retail restructuring in Texas has diversified the types of rates a commercial customer can choose from. In this analysis, I formulate a linear program to optimize commercial DER behavior over a variety of increasingly time-responsive commercial rate designs. We then utilize historic data from ERCOT and 15 commercial building load profiles to investigate how each retail rate design aligns with system and social objectives (in this case emission reduction).

We find that time invariant rates – such as demand charges - often provide perverse incentives to some classes of commercial DER applications that increase system-wide costs and can increase emissions. In comparison we find that exposing commercial DER customers to dynamic prices that better reflects real-time system needs decreases system costs and decreases emissions.

Advisor: Fred Beach