Time-of-Use Rates or Rooftop Solar?

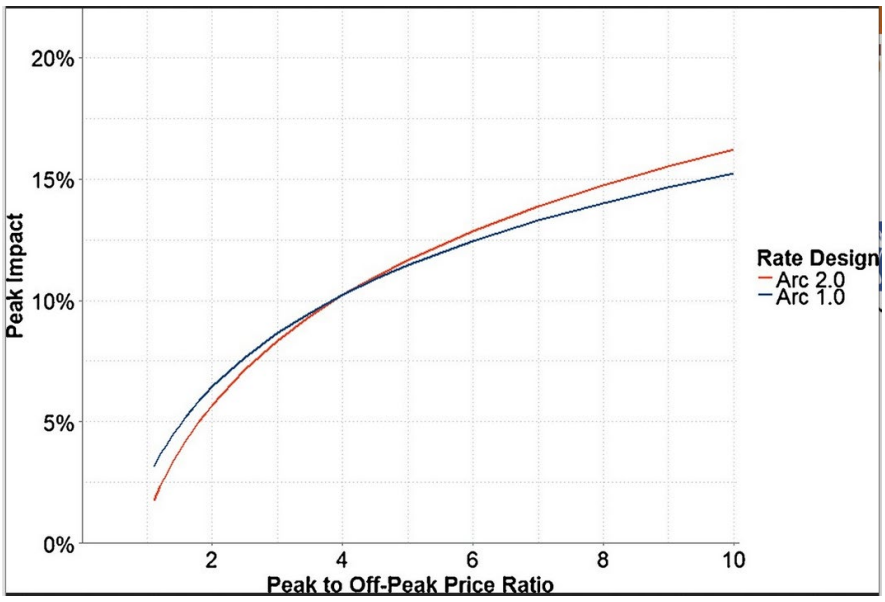
A Comparison for Perspective

Through the history of centralized utilities, the trade-off for exclusive territories was the requirement to provide “sufficient and reliable service.” It was a one-way flow of seasonally bloated demand which always concerned utilities. Air conditioning demand overheated and shortened the lives of all the distribution hardware from insulation on transformer windings to overheated lines to sagging into tree branches.

“Time-of-Use Pricing” (TOU) and related pricing programs have been the best solution that until now, utilities have devised to encourage customers to shift their electrical use to cooler times of the day. It prices electricity to the cost of both generating and delivering power. Ours is a summer peaking system driven by air conditioning demand. Members and customers control their own demands. Utilities can offer incentives and even technology (smart thermostats or text messages warning of higher billing), but a utility’s mandate has been to provide whatever power their members or customer demand. That top 3% of our customer demand dictates the sizing and cost, not only of peak generation, but of all transmission and distribution hardware. However, TOU has severe limits.

Dr Ahmad Faruqui is Evergy’s rate expert before the Kansas Corporation Commission. In a 2017 study, Dr. Faruqui analyses of 63 different utility pilot programs of Time-Varying-Rates. On his charts, Evergy’s demand could be reduced by only 6% by pricing Peak electricity twice as high as Off-Peak. Today’s TOU pricing from Evergy is 15¢/kWh and Off Peak at 7¢. If they wanted to get a 10% demand reduction, it would have to be 4:1 ratio (28¢ Peak to 7¢ Off-Peak).

Faruqui, Arcturus 2 2017



Evergy Time-of-Use Rates (Sept 2021)

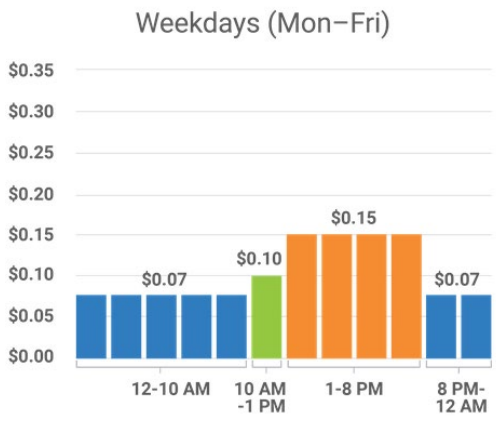


Chart example shows summer rates*

Time-Varying-Rates are a very complicated process: Should customers opt-in or out? Are they to be incentivized or penalized? Are they to volunteer to set back their thermostats or can the utility be trusted to set it back for them by signals from the powerline? Kansans don't like giving over that control. Evergy ended the program for automatically setting back thermostats because there were too few enrollees. And then you have to recruit and train new enrollees as families move in and out of your territory. If a utility defines the peak period to longer periods, there will be fewer families who will choose to wait until off-peak periods to, for example dry their clothes.

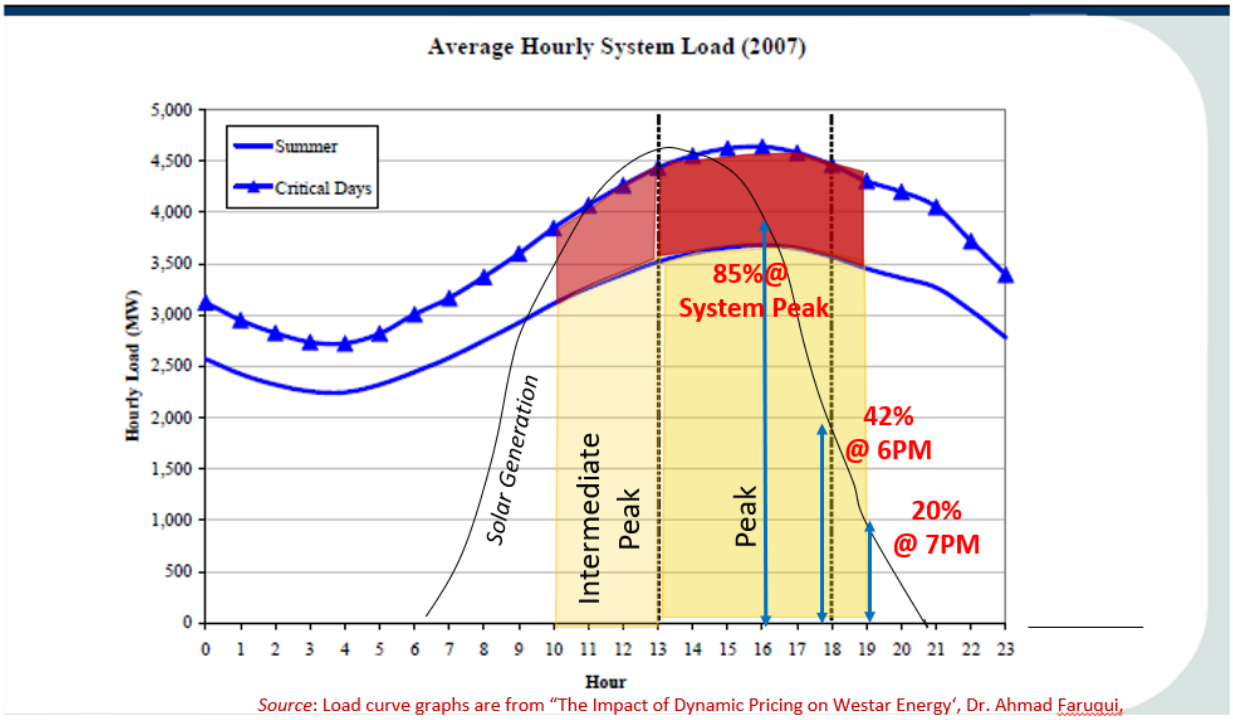
Are the results worth the cost in advertising and enabling technology? TOU is not a perfect tool for reducing demand on the grid because it depends on human behavior.

Rooftop Solar

Dr. Faruqui also produced the only publicly available load curves for Evergy in 2009. While they are dated, our general lifestyles haven't changed dramatically enough to effect the outcome. We can also assume that rural Kansans live very similar lives to their urban cousins.

If we take Dr. Faruqui's system load profile (because we are concerned with effects on the system, substation or feeder…not on the hosting rooftop solar customer's load profille), and superimpose the solar generation curve from the National Renewable Energy Laboratory, add the intermediate peak time, we can see that peak demand can be reduced by somewhere close to 85%:

Demand Reduction by Rooftop Solar from the KCC-Westar TOU Pilot Study



Source: Load curve graphs are from "The Impact of Dynamic Pricing on Westar Energy', Dr. Ahmad Faruqui, Smart "Grid and Energy Storage Roundtable", Brattle Group, September 18, 2009. Solar profile from NREL

Dr. Faruqui's studies show that Time-of-Use can be boosted by about 4.6% with "enabling technologies" like water heater timers or air conditioner set-backs, but the same technologies can as easily be applied to rooftop solar to boost its contribution.

The Kansas Legislative Coordinating Council was authorized to study of retail rates of Kansas electric public utilities for release in July 2020. The second part of the report by AECOM Engineering found that "Solar PV Output during Top 3% of Summer Hours vs. Nameplate Capacity by Confidence Factor shows the SPP-calculated value of solar PV for transmission planning purposes under their current approach. Using this approach, the value of solar PV is assumed to reduce transmission peak demand by around 70% of its nameplate value." This closely follows the reductions in our load curve chart.

It is important to note that the 2009 report by Dr. Faruqui found the Westar peak to be from 1PM to 6PM. During the hearings on Net Metering, Westar minimized the value of distributed solar by stating the peak period was from 1PM to 7PM. And in its latest hearings on charging a "solar access fee" Evergy again changed the definition of the peak period. It is now suggested to be from 1PM to 8PM.

With Time-of-Use pricing, a household is even less likely to avoid laundry every day, 365 days per year with a longer peak period from 1PM to 8PM. So, the percentage of compliance will drop below even 6%. Yet the TOU household is not thought of as an "intermittent" value to the utility.

Weather data from the Kansas State University Weather Library shows that for the hottest year for which hourly cloud and temperature data is available, 2012… 94% of the critical peak hours are cloudless, and another 4% are less than 50% clouded. The same occurs in the winter when the coldest days are always clear. A snow blower to the panels and we have full production.

Once a rooftop solar array is plugged into the grid, its generation follows the sun's path through the sky, regardless of human behavior, with 70-85% reliability - for the 25-year life of the system. Yet rooftop solar is labeled "intermittent."

As a utility concerned about cost and shortened lives of all distribution hardware, it makes sense to start from a simple platform that can provide a consistent 70% reduction in peak demand instead of a complex strategy that depends on fuzzy human behavior to reach a 6% reduction.

PS: AECOM also states "The model suggests that current NEM rates may have resulted in solar PV adopters cross-subsidizing other ratepayers, particularly in the case of commercial and industrial customers."

"Study of Consequential Issues Materially Affecting Kansas Electric Rates, Part 3", Lightly Redacted Version, Sept 2020

Ahmad Faruqui, Sanem Sergici, Cody Warner, "*Arcturus 2.0*: A meta-analysis of time-varying rates for electricity" **The Electricity Journal** ,Volume 30, Issue 10, December 2017, Pages 64-72