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Electricity Regulation and Rate Structures
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Introduction

Public utilities are a necessity for all households. Regulation of these utilities is also a necessity to ensure that the corporations that manage these utilities are not monopolizing the market in order to charge a higher price and restricting output. In this paper, I will discuss how utility regulation began, how regulation has evolved over time, present-day impact of utility regulations, and where regulation may evolve in the future. Specifically, I will focus on the following aspects of regulation: rates based on usage, rates based on the time of day or year, what percent of the utilities are a flat rate, time varying, and consumption varying (increasing or decreasing). The analysis will include impacts of the rates and what scenarios each structure would be most effective.

There are several different types of electricity rate structures. The simplest structure is the flat fee structure where a consumer will pay one fee no matter what the usage level is. Constant block pricing is a strategy where each unit of a utility used will have the same price. There are several tiered structures including inclining block and declining block. Tiered pricing strategies change the per-unit price of a utility as usage increases or decreases. Time-of-usage rate structures will vary price by time of day and time of year. Finally, two-part pricing structures have a flat fee for delivery and a per-unit rate on top of the initial fee. Each of these pricing strategies will be discussed in-depth later in the paper. The rates given as examples in the paper are all taken from openei.org.

After I have reported on the history of electricity regulation and pricing structures, I will present general advantages and disadvantages of regulation

along with opinions of what the most effective method of regulation would be. There will also be an analysis of what the impacts on consumers are, both positive and negative for each type of regulation.

History of Utility Regulation

Obviously utilities were not always regulated. At one time, utility companies were unregulated and free to do what they pleased. This led to monopolies being created, unstable rates, and overall inefficiency in the industry. Federal and state governments created regulatory agencies to combat the negative effects of predatory utility companies.

Why regulation began and how it evolved

There are several reasons for the beginning of utility regulation. Not only were consumers paying high prices on utilities, the large number of electrical companies in highly populated cities were using so many electrical wires that the city skies were littered with them. This problem was not just an eye sore for the community; it added to the cost of electricity because fixed costs of wire was extremely high. This is a natural monopoly because the costs are sub-additive. This means that if one company were to lay their one set of wire to be used by the entire market, it is cheaper than two or more companies running the wire as well. The reason we believe this to be true is the high fixed costs of distributing a utility and the relatively low marginal cost of reaching one additional customer.

Since it is more efficient for one company to produce the entire market demand, rather than one company being a monopoly that would restrict output and increase prices, governments created regulatory agencies that would set rates to control the natural monopolies. Regulators would essentially create an environment that would act as a perfectly competitive market. These rates are designed to promote the most efficient price possible that would give the consumers affordable utilities while the firm could earn accounting profits but economic profits would be zero.

Evolution and Future of Regulation

There are currently many changes happening across the nation. Each state passes laws regarding regulation of electricity and there are many different solutions to the problem. In Illinois, the electricity industry is deregulated, meaning that there are zero profits earned on delivery of electricity, but there may be profits made on the production of electricity. This opens the door for competition. For example: in Illinois, ComEd is a 3rd party distributor of electricity, meaning consumers can choose ComEd for their electrical needs if it will give them a cheaper rate.

The wholesale market also affects electricity prices. Like pork bellies, electricity is a commodity that is traded by brokers to make a profit. Because of deregulation, electricity is sold from the producer for a profit. Wholesalers then sell the electricity for a profit to distributors or customers. The wholesale market will likely continue to have state-level regulation with price caps rather than cost-based

regulation. A retail model can operate with no regulation as long as there is true competition between retail companies. (Douglas)

This new competition is forcing existing companies, which were previously monopolies, to innovate in order to stay competitive. It is now not acceptable to provide electricity. The distributor must provide electricity at a cheaper price and with less frequent, shorter lasting blackouts. Smart grids are one possible solution to fewer blackouts. Our existing electrical grid was built in the late 19th century and is no longer efficient as consumer behavior has changed. Our current network of smaller, local grids cause blackouts to have a "domino effect" where other areas of our infrastructure such as banking and traffic signals are affected. (smartgrid.gov) A smart grid would be able to detect outages and isolate that incident so they do not become large blackouts.

Smart meters are a type of developing technology that keep track of a consumer's usages by the time of day. Currently, most customers have meters that keep of track of the number of kilowatt-hours used in a month but the meter does not know when the electricity was used. Because electricity is not easily stored and in consumed virtually at the time of production, electricity companies must have a larger capacity for producing electricity at peak demand hours (This will be discussed in greater detail in the Time of Day Pricing section). Smart meters will provide incentives for customers to consume electricity when it is cheaper, during off-peak hours. Electricity companies will subsequently not have the need to invest in large capacity capabilities for peak demand hours.

Without deregulation of the electrical industry, these smart technologies would not exist because there is no incentive to innovate. As we move forward and states that have not yet deregulated observe the deregulated states, there will be more changes across the nation. Once we get to a point where most, of not all states are deregulated, there is the possibility that interstate competition will begin. Smart grids will allow for ease of transportation of electricity over longer distances, opening a possibility of this type of increased competition.

Finally, the changes in electricity distribution are leading to municipal aggregation. Many townships and cities across the nation are placing bids to buy bulk amounts of electricity and then selling the electricity to its citizens. The theory is that since the municipality can get a cheaper price if they purchase the entire demand of electricity for its citizens. The problem that arises with municipal aggregation is that officials of the municipality are negotiating for everyone. This does not necessarily give every individual the best rate possible because they cannot evaluate what option would fit their situation best. For example, some customers get a large discount after consuming 800KWH in one month because of the declining block price that was set to promote electric space heaters. (Obertino)

Electricity production and distribution is a constantly changing environment. As more windmills are being erected, smart meters being installed, and a smart grid develops, regulations of the industry will also adapt. Competition is expanding and consumers are becoming more aware of alternative options such as municipal aggregation. The future of regulation is not easily predictable because at any

moment an innovation could break through and revolutionize the way we produce, store, and distribute electricity.

Advantages and Disadvantages of Utility Regulation

Utility regulation, like anything, will have some advantages and disadvantages associated with it. The goal of regulation is to provide steady prices and efficient uses of resources, but this does not always happen. There is potential for capture where the regulations benefit the utility company or a lack of incentives for innovation. Not all regulation is the same, so we must generally state what the advantages and disadvantages could be in some cases.

Advantages

If regulation works correctly, the result should be an efficient allocation of resources with prices set that are beneficial to both the consumer and producer. The greatest advantage is the steady prices that result from regulation. Since the utility companies are told how much they are to charge over a given time period, its consumers will know how much they will pay for each unit of electricity they will use. The added certainty provided from a consistent rate will lead to overall consumer confidence in the economy.

Another goal of regulation is to promote efficiency. If rates are set correctly, it should "provide clear, efficient, effective, informative, and cost-effective market signals about the present and the future cost of service to buyers and sellers, (which requires that prices track costs); should embody strong incentives for

optimal present and future cost and service quality configurations; should give buyers and sellers optimal flexibility in selecting sellers and buyers respectively; should allow utilities to serve as agents of progress; should maintain or improve distributive equity, and should allow for the attainment and maintenance of a flexible regulatory framework with a modicum of necessary delay and obfuscation (and even a willingness of a commission to dissolve itself under the appropriate competitive or contestable conditions!)." (Bonbright, 2)

Disadvantages

Regulations began because of public interest, meaning that it was in the public's best interest for one company to be a regulated natural monopoly and supply the entire market demand. The intentions are good in regulation, but things sometimes change. It is possible that some regulators will be captured by the utility lobbyists. This means that the regulators fail and provides unfair advantages for companies rather than the efficiency that is supposed to be promoted.

I believe the major benefit for utility companies that comes from regulation is protection. States that are not yet deregulated have one company producing and distributing their electricity with no competition. This will lead to more rent-seeking behavior. The companies will try to take more of the consumer surplus rather than creating new wealth that will benefit both the producer and consumer. These regulatory standards lead to a lack of incentive for innovation. Utility companies have no reason to invest in advancing technology because they are told

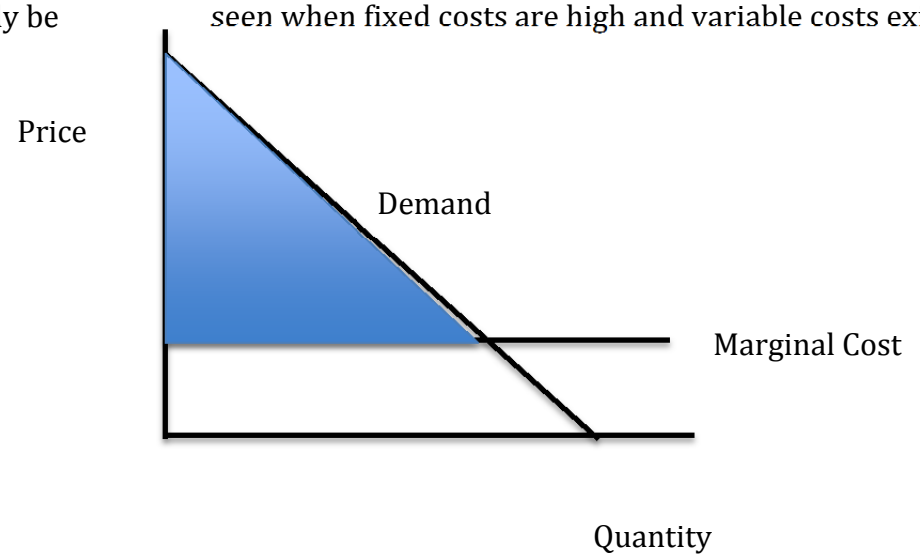
how much to charge. In deregulated states, the utility companies must advance themselves in order to keep up and get their customers to stay rather than opt-out for a 3rd party distributor.

Price Structures

In attempting to establish a price structure that is fair to both consumers and producers, there are several different options. Each pricing option has a specific goal and purpose. Some of the problems that are being addressed in price structures are high fixed, high marginal cost, or a combination of the two. The possibilities range from one flat fee for a period of time (which would indicate large fixed fee and low marginal cost) to a two-part pricing strategy combined with tiered pricing (which would indicate large fixed fee and large high marginal cost.

Two-Part Pricing

Many services that an electricity company will offer have 2-part pricing strategies. They will have an up-front fixed cost that will be paid every month, followed by a variable rate. This is a pricing method that is designed to ensure that a large portion of fixed cost is covered regardless of the quantity used. This would typically be seen when fixed costs are high and variable costs exist.



In the graph, the marginal cost curve is horizontal, representing a constant rate for each unit of electricity consumed. The difference between this and the constant block pricing method is the blue triangle. The blue triangle represents the consumer surplus of the electricity. The fixed fee that is associated with the 2-part pricing will take a portion of the consumer surplus (perfect 2-part pricing will take all of the consumer surplus) and give it to the producers. Since this is simply a transfer of social welfare, there is no deadweight loss in 2-part pricing. The City of Memphis, Tennessee is a good example of 2-part pricing. Their commercial general power rate has a fixed fee of $1,850 followed by per-unit rates.

Flat Fee

The simplest pricing structure is the flat fee. A flat fee is a one-time payment per given time period that covers any level of usage. The best situation for the flat fee would be an industry where there are very high fixed costs and very low or no marginal costs. Electricity does not use the fixed fee pricing structure because energy production costs are variable.

The flat fee would best be suited for an item such as rent. Rent is used for a durable item where there is no variable cost to the owner of the item based on usage. Fixed costs are high for rented items and they are very predictable. These are the best conditions under which a flat fee would be used.

As previously mentioned, to produce one additional unit of electricity, the electricity company will increase their costs. Since it is hard to forecast exactly how much electricity will be used, there would be a high risk of loss. If customers were

being charged the same price regardless of usage, they would not attempt to conserve energy. This would put a large strain on electricity production capacity trying to meet the high demand and the prices would ultimately be very high. The flat fee is not an efficient way to price electricity.

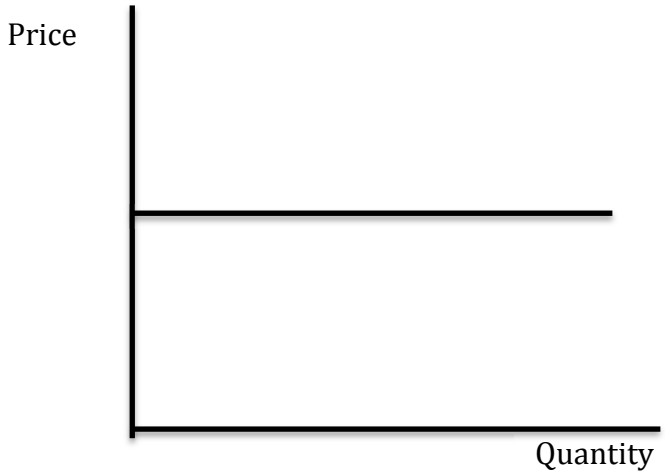
The only time when an electrical company will have a fixed fee on their product will be in a service rather than on the electricity. For example, Maine Public Service Co. has fixed fee on their product Backup and Maintenance Service-Primary (B). This is a product that non-residential companies can buy that will provide maintenance service when the company does not regularly deliver the electrical requirements.

Constant Block

The simplest pricing strategy that is actually used in the electrical industry is constant block pricing. Under constant block pricing, price is fixed per unit and varies in total, meaning that as quantity consumed increases by one unit, the total cost will increase marginally by a fixed amount. This will be used when fixed costs are low but variable costs are high. The fixed costs are easily spread out over the large quantity of electricity consumed and the variable cost for producing additional electricity is built directly into the rate. For example, if the fixed costs are $100, the variable costs are $5 per unit, and a company expects to sell 1,000 units, the total cost would be $5,100. Rather than taking a risk on a flat fee, the company can cover their cost by charging $51 and breaking even.

A real world example of constant block pricing is Southwestern Electric Power Co (Louisiana)'s pricing on general lighting and power service (Effective 4-1-

2008). This utility does not charge any type of fixed fee and charges $.02 per Kilo-Watt Hour KWH consumed no matter the time of day, season, or total amount of electricity consumed. We can assume that the variable cost of producing the electricity are less than $.02 and the quantity of electricity used by consumers is large enough such that the fixed costs are spread out over the market.

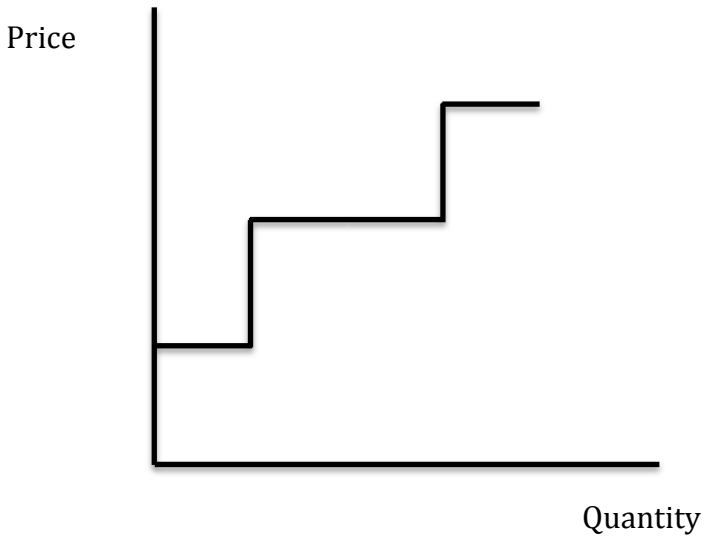


This graph demonstrates constant block pricing because as quantity increases, the price per unit of electricity consumed does not change. This would be applied when fixed costs are relatively low and the marginal cost of producing large amounts of electricity is the same as the marginal cost of producing small amounts of electricity. There are also no incentives given for people to consumer more electricity.

Inclining Block

One of the types of tiered rate structures is inclining block. Under inclining block pricing, as quantity of electricity consumed increases, the price will increase as well. This is commonly seen in telecommunications with cell phone minute rates. A customer normally has a plan where they pay a set amount per month for a given number of minutes and if they go over that number of minutes, they pay a higher rate. This can also apply to electricity.

Although not as common as declining block, inclining block pricing does happen. Electricity regulators would implement an inclining block rate structure if they were trying to promote energy conservation. The theory would be that people would keep track of their usage and ration their electricity usage in order to stay in the lowest tier price.



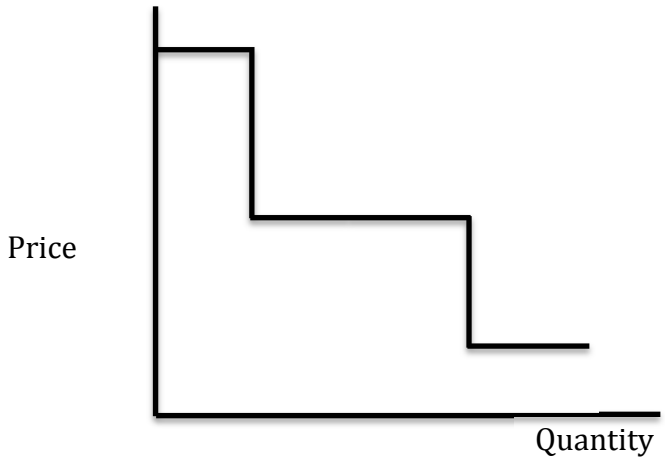
In the graph above, the line is staggered because the producers will charge only one per-unit price as the quantity of electricity increases until a new level of

quantity is reached. After that point is reached, the consumer will be charged a new, higher price until the next tier is reached. It is important to note that as the consumer reaches the next tier of prices, the increased price is applied to only the quantities associated with that price.

Declining Block

Declining block pricing is used to provide discounts to consumers who use large amounts of electricity. In Illinois, declining block pricing was one tool that was used to promote electric space heaters. Ameren decreases electrical rates after 800 KWH are consumed in winter months only because of this push for space heaters. (Obertino) Declining block could also be used to recover some fixed costs with the initial higher prices.

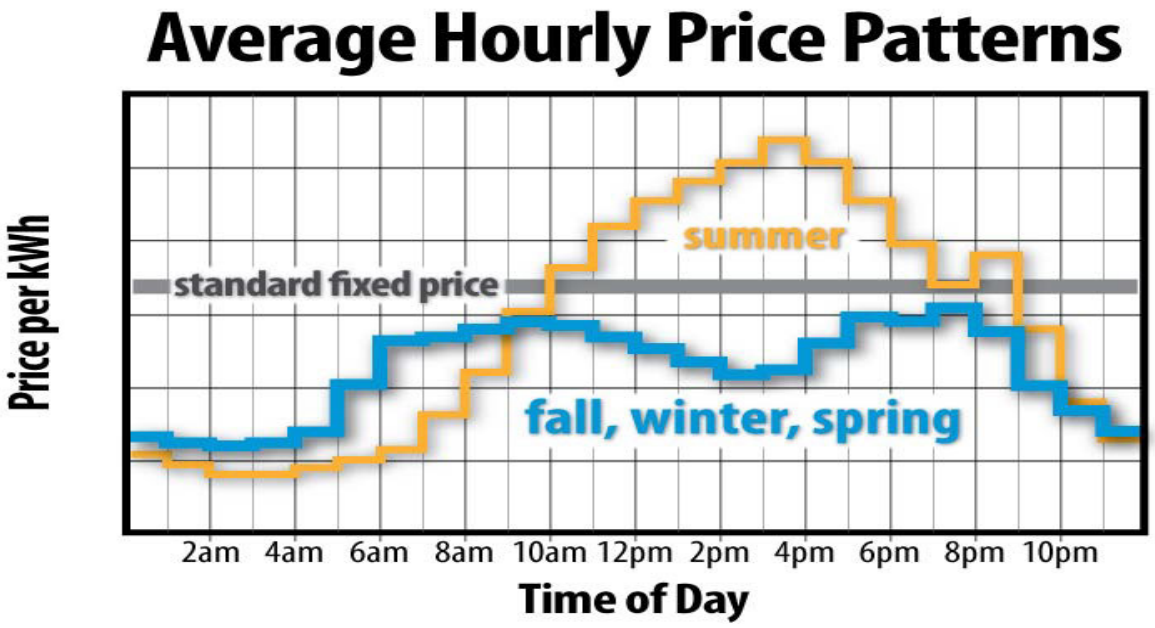
Declining block pricing is a form of second-degree price discrimination. The marginal cost is the same for producing each level of consumption for a given month, but the price is different. This is justified because the declining block rate is available to every customer. Some would argue that the lower rates would only be attainable by some consumers, each customer will pay the same rate at a given level of consumption.



The price is again staggered but this time is staggered downward rather than upward as quantity increases, representing that as a consumer reaches a new tier of usage, their individual price will drop, again only for the quantity associated with that rate.

Time of Day Pricing and Seasonal Pricing

Time of day pricing is a variable pricing where the price does not vary by usage, but rather the time of the day that the electricity is being consumed. Smart meters are a very important for tracking time of day pricing. The reason that prices would be different for times of day is that there are different levels of demand for different times of day. Since electricity cannot be efficiently stored, producers must have the capacity to produce the entire market demand at any given time. For the same reason, prices are also different in varying seasons. Summers typically have higher rates because of air conditioning usage.



(Powersmartpricing.org)

The above graph demonstrates both that rates increase during high demand hours and that rates are higher in the summer as the temperature increases because of the increased usage of air conditioning. This type of pricing will become much more common in the future as smart meters are installed across the nation. Although most people are not being charged the time-of-day usage rate, the rate still exists for those who do own smart meters. For example, Entergy Mississippi Inc charges different rates for their GS-295X products. During the weekday hours of 10:00am-7:00pm, rates are $.14, while during other hours the rate is $.06.

Combination of Multiple Pricing Methods

Based on a random sample of 1,000 observations from openei.org, the two most common combination pricing strategies are the combination of time-of-day

pricing with seasonal pricing and 2-part pricing with some kind of tiered rate structure (Inclining or declining block). Again, air conditioning is the major driving factor between the connection with time-of-day and seasonal pricing correlations. Not only does the demand for electricity spike during the summer for electricity, demand is even higher in the afternoon hours of the summer, causing rates to be higher in the summer days than the summer nights. The combination of a 2-part pricing strategy and tiered pricing strategy would result from high fixed costs that will be covered by the fixed fee and variable cost that either gives a benefit to consumers for using more electricity (Declining Block) or punishes consumers for using more electricity (Inclining Block).

My Analysis

I believe that different rate structures should be an option everywhere. Although we are on the right path of making this happen, it is taking far too long and there is a great lack of knowledge about the subject. Smart meters are available but not many people take the opportunity to have them installed. The implementation of smart meters will promote proper energy conservation at peak demand hours because consumers will not want to pay the higher price. (Obertino) The electricity companies will benefit from this because they will not need to have the greater capacity that they currently do. This more accurate pricing method would increase customer satisfaction because their bills should decrease. Municipal aggregation is another relatively new innovation that presents consumers with another option for electrical needs.

Price discrimination does exist in tiered pricing structures for electricity. The proof is simple, each additional unit of electricity produced costs the producer the same price, but the price charged to consumers changes. This is clear price discrimination. To determine if this is illegal we must examine the impact on competition and the impact on consumers. First, there is no impact on competition in the states that are still regulated because there is no competition. In deregulated states, competition is not damaged because all producers offer incentives for bulk buying. Second, there are very good reasons for tiered pricing structures that benefit consumers. Declining block was created in part as an incentive for consumers to use electric space heaters. For this to work more effectively, the declining block was made so consumers would not feel a heavy burden of electricity costs. Although not everyone is charged at a lower rate tier, every consumer is eligible for the lower rate, so this is not illegal.

In the future, I see regulations becoming more relaxed as competition increases. The major technological breakthroughs that will drastically change regulation are storage capacity and smart grid capabilities. Once we have the ability to store large amounts of electricity for long periods of time combined with the ability to transfer energy over long distances, the renewable energy market will grow exponentially. Currently, our renewable energy system is limited because the sun doesn't always shine and the wind doesn't always blow. With these two new technological improvements, we could place solar panels and wind turbines in many locations, store the energy that is not currently needed, and transport it great

distances. For example, we could place many solar panels in the southwest deserts and use that energy to provide power to the west coast.

Conclusion

In summary, utility regulation has been very necessary in the past. As times change, regulations have adapted to the changes. Regulation does sometimes hinder advancement in aspects of electricity production and distribution such as a lack of incentive for innovation and promotion of rent-seeking behavior rather than new wealth creation. There are also positive aspects of regulation such as the goal to find the most efficient price and steady rates.

Understanding electricity regulation and rate structures are important to consumers because one can save money with this knowledge. There are many options available but they are not being taken advantage of because of a lack of public knowledge. Knowing when to use electricity will result in less usage during peak hours, driving the cost down. Capacity will not need to be as high because the usage will be spread more evenly over the entire day.

Along with the changes in regulations, there are many changes happening in the rate structures. Each structure is designed to solve a problem in the most efficient way to solve problems that arise from high fixed or variable costs. Since regulation is designed to simulate a competitive market, real competition is decreasing the need for regulation. States that are still regulated are hurting their consumer base and over protecting their utility companies. Only time will tell how regulators will adapt to changing times as we develop new technologies and

competition is increased. The capture of large utility companies will have some impact as they seek greater rents, extracting as much consumer surplus as possible.

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