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SMART METERS, REAL TIME PRICING, AND DEMAND RESPONSE PROGRAMS:

IMPLICATIONS FOR LOW INCOME ELECTRIC CUSTOMERS

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SUMMARY OF FINDINGS AND RECOMMENDATIONS

The push to install more expensive smart meters (and their associated communication and data storage systems) and consider more "real time" or volatile electricity prices for residential electric customers has the potential for significant harm to many residential customers and particularly to limited income and payment troubled customers. Almost no jurisdiction has acknowledged the potential adverse impacts on these vulnerable customers who must have essential electricity service to assure household health and safety. Nor has any jurisdiction specifically ordered an analysis of proposals for dramatic changes in the pricing of electricity on limited income or payment troubled customers.

The repeated calls to link retail prices with short-term wholesale market hourly or day-ahead prices assumes economic validity of those price signals[1] and requires state regulators to promote the installation of more expensive meters and communication systems to achieve their rate design goals and objectives. Whether or not the rate designs are initially labeled "voluntary," the fact that more advanced meters are being installed or proposed for universal installation on a system-wide basis suggests that the "voluntary" label is temporary at best.

Finally, the more advanced meters with two-way communication systems carry significant implications for customer service, privacy, and consumer protection policies that have been viewed as either a benefit (as in the California Public Utilities Commission's analysis of the cost and benefits of the system-wide installation of smart meters) or completely ignored in terms of their possible adverse implications.

At a minimum, when faced with proposals to promote smart meters or any "real time" pricing proposal, advocates for limited income and payment troubled customers should call for an analysis of the impacts of the costs and the benefits to residential customers generally and more vulnerable lower income customers specifically. This analysis should reflect a bill impact analysis to pay for the new meters and communication systems at various usage levels, as well as a consideration of the consumer protection policies and programs that presently exist and that rely on personal contact and premise visits as a crucial aspect of the implementation of the notice and attempts to avoid disconnection of service.

It would be unfair and poor public policy to leap into new metering technology and new methods of pricing essential electricity service to residential customers without a careful analysis and access to factual information on the impacts of such proposals on customer bills and usage patterns. The lack of such information is particularly glaring for low income and payment troubled customers.

Rather than focus on passing through "real time price signals" to residential customers based on short term or spot market prices, representatives of limited income and payment troubled customers should consider reforms being adopted in some states that are designed to ensure long term price stability and long term lowest price for essential electricity service. These initiatives, often captured under the rubric of "portfolio management", require an analysis of the average price of electricity for the customer class and an acquisition strategy that is designed to dampen price volatility. As such, this approach is exactly the opposite of the recommendations of those who seek to pass through "real time" prices to residential customers that rely on wholesale spot market price changes. There are legitimate concerns that have been raised with the structure and operation of the current wholesale markets. These concerns point to the potential for market manipulation, lack of sufficient competition, and the structure of the market pricing mechanisms themselves. Wholesale market structure and pricing mechanisms are still being vigorously debated and to rely entirely on such immature and potentially "wrong" price signals to customers who rely on essential electricity services for minimum health and safety standards should raise red flags and longer term analysis prior to embarking on expensive new metering and rate design programs that appear linked to promoting more volatile pricing methods for residential customers.

Finally, advocates for limited income and payment troubled customers should ask for the development of the least expensive demand response programs that are likely to benefit all customers and focus on closely linking the demand response programs with those specific customer usage profiles that are likely to contribute to the objectives of the program in the most cost effective manner. Typically, this would require an analysis of simpler direct load control programs that reward the participating customer for a modest level of interruption or appliance cycling and are typically not intended to "punish" lower usage customers with higher prices at peak usage periods. Also, a rate design change to inclining block rates could send gradual price signals to all customers as their consumption increases. In addition, proponents of real time pricing programs often claim that the reduction in peak usage would assist in the ongoing efforts to reduce greenhouse gas emissions from power plants that contribute to global warming, on the grounds that reducing peak demand will reduce the need for new generation resources or reduce the need for reliance on gas-fired generation units, often the most expensive unit at the peak periods. However, logic suggests that shifting more usage to off peak periods would require an increased reliance on baseload generating plants which are typically coal-fired and nuclear generation. Any claims of environmental benefit should be carefully examined to determine whether most of the peak usage is just shifted to off peak hours, thus limiting any environmental benefits associated with these programs.

Any program that is aimed at residential customers in the form of a pilot program to test TOU or CPP options or rate designs should include identified low income customers with usage that is lower than average residential customers and analyze the impacts of such programs on those customers who do not or cannot take actions to avoid the higher peak prices. Finally, any pilot programs should require an independent evaluation that asks the hard questions about whether the program as designed or implemented can be rolled out to a sufficient number of residential customers to achieve its intended objective and at what cost.

It may be wiser to focus first on the very high use sub-class of such customers who typically have the financial ability to actually respond to peak prices and the usage profile that reflects the potential peak shaving or peak load reduction that is the intended purpose of such programs. Even with this subgroup, however, there may be serious obstacles to any requirement for real time pricing. For example, New York previously had a mandatory time of use rate for very high usage residential electric customers. Despite the presumed ability of very high usage customers to adapt to time of use rates, the program was so unpopular the state legislature amended the law to make any residential time of use program voluntary.[2] Maine's mandatory

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TOU rate program, adopted at a time of price stability, was abandoned with a dramatic increase in electricity prices and the onset of electric restructuring. Puget Sound Energy in Washington abandoned a system-wide move to TOU pricing for residential customers when it became clear that the additional costs of the new communication and billing systems could not be avoided with average monthly bill savings.

Advocates for limited income and payment troubled customers should carefully examine proposals for "pilot" real time pricing programs, as well as utility proposals to install smart meters throughout its service territory. Such proposals should be examined in contested proceedings with a full airing of the proposed costs and benefits of such programs, , with a particular requirement that the impacts on lower income residential customers be undertaken. While utilities may seek to first install the smart meters (and obtain regulatory approval for cost recovery) without linking such meters to more volatile "real time" pricing options for residential customers, any such proposal should be reviewed with the understanding that more volatile pricing programs are sure to be offered and perhaps eventually mandated.

Appendix A contains suggested areas of concern and questions that should be asked and answered when considering the system-wide installation of smart meters and any suggestion that future benefits may be recouped by introducing more volatile real time pricing programs for residential customers. While the benefits of such meters and their communication systems may be justified for outage management, automatic meter reading and reductions in utility meter reading costs, more accurate bills, and their impact in allowing the utility to better integrate and manage its distribution system, the implications of these systems, particularly the more volatile pricing methods being promoted as part of the justification for smart meters in many states, for low income and payment troubled customers has not been fully explored or acknowledged.

INTRODUCTION

While electricity prices are increasing in many states due to the impacts of retail electric restructuring and higher fuel costs (particularly natural gas) used in electric generation power plants, another development is likely to have an even more significant impact on the ability of limited income and payment troubled customers to obtain and maintain essential electricity service. Federal policy, some state regulators, and advocates for "sending the proper price signals" to all customers support the installation of "smart meters" and changes in how electricity is priced. In some cases, customers will be offered the option of "time of use" or "critical" pricing programs that vary the price of electricity by the time of day or the volatile prices of a wholesale spot market. In other cases, customers will be offered the option of interrupting or reducing usage of key appliances in return for a bill credit or other means of rewarding the customer for taking actions in response to higher wholesale spot market prices. In some cases, regulators will order the mandatory installation and funding for new meters and communication technologies and make permanent changes in how electricity is priced. In general, the overall trend of these initiatives will be to raise electricity prices to pay for the new meters, installation and maintenance of the new meters, new communication facilities, new computers and software to receive and process the information from the meters, and new billing systems to implement the pricing changes. A move to make electricity prices more volatile (i.e., changing more frequently than in the past) and with more difference between "high" prices and "low" prices at different times of day or year would be a major break with longstanding state legislative and regulatory policies to stabilize rates of residential and small business consumers.

The purpose of this paper is to educate consumer advocates on the state and federal developments that are promoting "smart meters", "real time pricing", and "demand response" programs for residential customers and to highlight the potential concerns and impacts of these programs and policies on limited income and payment troubled residential customers.

By "limited income" I refer to residential customers whose household income qualifies the household for participation in one or more of a State's means-tested financial assistance programs, such as Low Income Home Energy Assistance Program (LIHEAP), Medicaid, Food Stamps, prescription drug assistance, WIC, telephone Lifeline, and similar programs. While most of these programs rely on a household income qualification that is at or below 150% of Federal Poverty Level, others use a slightly higher income qualification. In all cases, the programs are designed to assist households with insufficient income to meet their vital and essential needs for shelter, heat, electricity, medications, and food.

By "payment troubled" I refer to residential electric customers who demonstrate an inability to make regular monthly bill payments in full and who have frequent contacts with the utility concerning bill payments, enter into deferred payment plans, who frequently make only partial bill payments, or who need referrals to public assistance or charitable aid in response to notices of disconnection of service. These customers may have "limited income" but include those who are just above the more traditional definitions of poverty in many programs and who encounter bill payment difficulties.

In this paper I use the term "smart meter" to refer to a meter that has the capability to record and store information about a customer's electricity usage by time of day and is linked to a two-way communication system with the utility. In most cases, this requires a meter other than the typical mechanical meter already installed for most residential customer electricity services. These older meters are relatively inexpensive and reliable, but they only record continuous electricity usage with a mechanical dial. It is possible to "read" such meters more frequently (and thus obtain usage information at certain times of day), but this requires the installation of an additional communication system to access the meter reading several times a day. More typically, a "smart meter" is a new meter that has the capacity to store electricity usage according to various time periods or intervals that are programmed into the meter. In other words, the older meters are best thought of as an analog device and the newer meters as a digital device. While "smart meters" do not themselves require a two-way communication system to operate (i.e., the data they contain can be obtained with visual meter readings or by a one-way transmittal of data to the utility), typically such meters are also accompanied by a new communication technology that allows two-way communication between the meter and the utility by means of a high speed communication system that relies on radio or wireless communications, broadband power line transmission, or copper wire (telephone) communication devices.[3] A centralized database is maintained by the utility of continuous or frequent meter usage readings for each customer. This information can be used to issue customer bills, analyze usage profiles, and design and implement new electricity pricing programs. When the utility has direct contact with the customer's meter, the utility can also turn the meter on and off from a central location, i.e., start service and disconnect service without a premises visit.

The term "real time pricing" is used to describe how the more sophisticated or more detailed information derived from the smart meters is used to bill end use customers. This type of pricing is also referred to by its proponents as "dynamic pricing." Typically, smart meters are accompanied by a proposal to change the way in which electricity is priced on the customer's monthly bill. These electricity pricing programs (known in the regulatory world as "rate design") vary the price of electricity according to time of day or even every hour, charging more or less for electricity based on higher production costs, in states with vertically integrated

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utilities, or conditions in a wholesale electricity spot market in states where distribution utilities have divested their power plants and must purchase wholesale energy for retail customers. At its most basic, "real time pricing" means that a customer is charged more for electricity at peak periods when production costs or wholesale spot market prices increase (due to high demand and the need to turn on the most expensive generating resources) and less for off-peak periods when there is likely to be a larger surplus of electricity and lower demand (and when the least expensive baseload generating units are used). In regional wholesale markets, higher peak hour prices are also a reflection of transmission constraints and pockets in which there is insufficient transmission capacity to send otherwise available electricity to customers.

The most typical type of dynamic or real time pricing programs that are being proposed and discussed in state proceedings include:

- **Time of Use or TOU** rates in which the customer's meter records usage by hour and charge different prices for different times of day. The TOU rates usually change once or twice per year (winter and summer) and, at a minimum reflect two time periods, peak and off-peak, but sometimes also include a "shoulder" price that is midway between the two extremes.
- **Real Time Pricing or RTP** rates in which the customer's meter records usage by hour and charges a different rate for each hour depending on movements in the wholesale spot market.
- **Critical Peak Pricing or CPP** rates in which some hours of the year during particularly high peak prices are charged a very high price. This option can be implemented with either TOU or CPP rate programs. The hours in question are

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typically fewer than 1% of the hours per year and the customer is notified at least one day in advance.

By "demand response" programs, I mean programs operated by utilities or wholesale market participants in which there is an organized effort to obtain a lower demand on the electricity system (i.e., reduce usage) so as to reduce the level of the peak period or to shift usage to lower peak periods. Proponents of demand response programs often suggest that properly designed programs can substitute for building new generation or lower prices for all customers if the usage at the peak period is reduced because of the significant impact that peak period prices have on the average price of electricity charged to all customers. Demand response programs are generally of two types: (1) the use of time of use or critical peak pricing programs to require the customer to pay more for electricity based on peak and non-peak system information so that the higher price acts as a signal to reduce usage; or (2) the use of customer credits or other incentives to allow the utility to directly control the use or load of a particular appliance (such as air conditioning) during the most extreme peak load conditions, typically 20-30 hours per year. A variation would enable the customer to adjust or shut off home appliances remotely, via internet or other means, when prices rise above certain levels.

Why should limited income and payment troubled customers be concerned about these developments? As will be discussed further in this paper, the system wide installation of smart meters and the promotion of more volatile pricing alternatives for basic electricity service, as well as the design of some demand response programs, raise important issues for customers who have difficulty making regular bill payments and whose household income may not support higher bills in some months in return for lower bills in other months. In some cases, these concerns are similar to those shared by all residential customers, but the impacts of these concerns resonate more deeply with customers who have difficulty making regular monthly payments based on current and rising electricity prices. Since electricity is vital to household and community health and safety, any development that may reduce the affordability of electricity or subject the monthly amount necessary to pay for such services to potentially significant volatility should be viewed with suspicion and alarm.

First, the installation of smart meters and the new communications and data management systems required to implement the new pricing programs, the design and implementation of new billing options with changes to the utility's customer service and accounting software, as well as the consumer education and communication programs that will be required, are likely to result in higher rates or prices for all customers. Even assuming investment in this technology has the potential for lower prices in the long run, most utilities will not choose or agree to absorb these additional costs in the short run. As part of the rate recovery proposals that are likely to accompany proposals for advanced meters is a suggestion that higher meter costs should be paid for with higher fixed monthly customer charges. Any rate increase is likely to have a more significantly adverse impact in the form of higher monthly bills on limited income and payment troubled customers, but higher fixed monthly charges have a more adverse impact on lower use customers where the fixed charges represent a higher percentage of the total monthly bill.

Second, the theory of more volatile pricing and "sending the proper price signal" assumes the spot market price is correct and reflects the marginal or incremental cost for electricity. The use of smart meters and dynamic or real time pricing means that electricity is not being bought with the objective of price stability or long term management of a diverse portfolio of contracts and energy management services. In other words the meters and the new pricing trends attempt to institutionalize the wholesale spot market as the method of acquiring and pricing electricity. This reliance on the spot market to buy electricity for residential (and small commercial) customers is directly contrary to initiatives in some restructuring states to adopt long term planning and portfolio management of electricity service and avoid the short term wholesale market ups and downs.[4]

Third, the use of more dynamic pricing methods assumes that every customer has the ability to respond to hourly or daily price signals. This ability is obviously easier for higher usage residential, commercial, or industrial customers who have greater flexibility for reduction or shifting the usage away from expensive peak hours and taking advantage of the option to lower bills and experience benefits. For example, an industrial customer could alter production patterns and operations to use electricity during lower cost periods. Some residential customers could lower the thermostat (for controls of home heating, home cooling, hot water, or pool pumps) at peak periods.

These options are not as easily available to customers with a fairly constant usage profile or who use such a low level of electricity that there is not a great deal of elasticity in their ability to reduce or shift usage, at least without suffering some potential discomfort or harm to health. Such may be the case with many residential customers and is more likely the case with limited income and payment troubled residential customers who typically use less electricity than their higher income neighbors.[5] The penetration of more energy intensive appliances is lower for limited income customers than for higher income customers. On average, limited income customers reside in housing units that are typically smaller in size and require less electricity to light, heat, or cool. This is true even though many limited income and payment troubled customers live in structures that are older and not properly insulated and often rely on older and less energy efficient appliances. However, those customers with poorly insulated dwellings, in need of repairs, or who rely on less efficient and older appliances, are the least able to fix these problems and take actions to reduce their energy usage due to their limited income. Also, low income renters may lack control over appliances provided by landlords, *e.g.,* inefficient heating systems, refrigerators or hot water heaters. These factors suggest that limited income and payment troubled customers are not as likely to be able to take actions in response to price signals that are available to higher income customers, such as investments in structural repairs, weatherization, upgrading appliances; purchasing energy savings control devices, etc. The only practical option available to these customers is to do without or make changes in their lifestyle or family schedules to avoid using electricity at certain times of the day, even when that may adversely impact their health. Finally, older consumers may need a constant level of heat or cooling to maintain a safe body temperature and "doing without" in the middle of a heat wave in order to avoid higher bills may result in dire health and safety consequences.

Crucial to any analysis of the impact of more volatile pricing programs on low income customers is the definition of "peak" period or hours by the local utility. If the peak electricity periods and the times of day in which electricity is likely to be priced the highest (early morning and late afternoon/early evening) are also those times of the day when most families must prepare meals (breakfast and dinner), provide heat (and cooling in warmer climates) and hot water for themselves and their children for baths and other household cleaning chores, the potential for adverse impact is higher. TVs and lights are operating when families are home, not in school, and not at work. While it is certainly possible to "teach" customers to do their laundry and operate dish washers after 8 PM, the bulk of electricity usage is not likely to be dramatically shifted for households when most of the usage relates to necessary tasks. Elderly customers and households with small children need to maintain a level heating and cooling temperature to avoid potentially dangerous health conditions. If the peak or critical hours typically fall in the summer afternoon a residential customers is at work, the ability to reduce air conditioning usage by increasing the home temperature may not adversely impact health and safety, although any such program should pay careful attention to the impact on elderly or other vulnerable residential customers who are at home and may rely on air conditioning to avoid adverse health consequences due to hyperthermia or who are suffering illness and other medical conditions that require cooling in hot weather and additional heat in cold weather.

When electricity prices are volatile, it may be more difficult for households with limited or fixed incomes to plan and accommodate significant changes in monthly expenditures. For example, limited income households are not necessarily benefited if the average annual electricity bill is lower when relying on higher peak period prices during some months of the year and lower than standard rates in other months or times of the year. If the size of any monthly bill is driven by high peak period prices or frequent critical peak hours, the unexpected expense can throw a customer into the nonpaying and collection cycle. Utility payment plans are unlikely to provide a solution when the bill is unaffordable unless the customer can shift the higher than normal bill into pay periods that correspond with lower bills. Any typical payment plan offered by utilities requires the customer to make a downpayment on the overdue amount and make regular monthly payments on the arrears balance along with the future monthly bills in full. While some claim that budget payment plans are useful tools for blunting fluctuations in bills, they are designed to average seasonal variations in a customer's consumption over the year and work best when prices are fairly constant. For a heating customer, the use of a budget payment plan shifts some of the winter bills impacts to the lower use summer bills. This payment option would blunt the intended impact of making customers "see" the higher prices at times of the wholesale system peak and respond to those high prices in real time. The use of TOU and CPP pricing makes the calculation of estimated future bills for a 12 month period more difficult and perhaps impossible. Furthermore, some utilities will not allow a customer in arrears to enter into a budget or levelized payment plan.

Fourth, the reliance on more volatile pricing options for residential service and the resulting impact on customer bills may have an unforeseen impact on the policies and delivery mechanisms with existing energy assistance programs. For example, the use of TOU or CPP options may result in higher overdue amounts, thus triggering more frequent requests for assistance and for higher amounts. If utilities can remotely disconnect service with such systems without the need for a field visit - and the possibility of a field payment, this is likely to increase the volume of disconnections, with the accompanying impacts on customers, communities, and social service agencies. Another impact may be the expansion of those who may have managed to "make do" under the prior method of charging for electricity prices but now require emergency financial assistance.

Finally, the installation of smart meters and their accompanying communication systems will allow utilities to remotely read, energize, and disconnect service. A likely result will be the increase in the volume of disconnections because such automated systems avoid the need to schedule field personnel and premise visits. Most utilities do not actually disconnect all those customers eligible for disconnection in any week or month due to operational constraints and the need to prioritize such field work with other operational obligations. Premise visits and "truck rolls" are expensive and often result in utilities making choices about the volume or type of disconnections that occur at any time. Also, field payments are sometimes made to forestall termination when the disconnection is being made or the field worker is made aware of a potential medical emergency that leads to a delay while the occupant obtains the necessary confirmation from a medical professional. When access to the meter can be accomplished remotely, utilities will not need to prioritize disconnections based on the amount overdue, for example, unless they choose to do so for other reasons. Furthermore, the elimination of the need for premise visits to effectuate the disconnection carries significant implications for current regulations in effect in many states that require the utility to attempt personal contact with the customer prior to disconnection in order to determine if a medical emergency is present or offer payment arrangements. As a result, reliance on remotely controlled meters is likely to result in a degradation of consumer protection and customer service compared to current practices.

Does this mean that any demand response program or TOU or CPP pricing option should always be opposed as harmful to limited income or payment troubled customers?

Not necessarily, because the "devil is in the details." The programs that are most likely to have a positive impact, i.e., lower customer bills and contribute to lowering peak usage at a modest system-wide cost, are those that are referred to as "direct load control" demand response programs. In such programs, the customer's appliance, typically an air conditioner, or a thermostat that governs the home heating and cooling system, is directly hooked into the utility's communication system and interrupted or cycled on and off for a few hours during critical peak periods. In return, the customer who chooses to participate may enjoy a near invisible impact on household comfort, the benefit of reduced usage on the monthly bill, and a customer reward or credit provided as an incentive to participate in the demand response program. Several examples of this type of program are described later in this paper. This type of program does not necessarily require advanced metering and the investment in the direct communication equipment is typically modest and far less than the savings seen by the utility in their management of peak usage. However, some proponents of these programs point to the more efficient use of advanced metering and the use of "smart" thermostats coupled with two-way communication systems as necessary for a more widespread use of direct load control programs. It is possible that a direct load control program may result in more targeted system-wide peak reduction benefits with fewer of the adverse potential associated with "real time" pricing that is being promoted by some policymakers, but the question still remains whether the costs and benefits of "smart meter" installation for all customers can or should be justified based on a more targeted program to only a subset of all customers.

It is also possible to construct a CPP option that results in customer bill savings if the there is a highly supervised customer communication and interaction program that links the advent of high peak usage prices with actions that the customer can easily implement without adverse impacts on household activities or health. Unlike the program in which the utility directly controls the customer's appliance or thermostat on certain peak hours, the CPP option requires the customer to take actions to reduce usage or shift usage to avoid the extremely high prices charged at a "critical peak" period. If the frequency of such CPP events is relatively low and the customer communication and education aspects of the program are well designed and successful, this type of program can be implemented without adverse impacts on health and safety, assuming the customers participating in the program have the ability, knowledge, and economic wherewithal to avoid usage or shift usage during these high price hours.

Rate options, such as TOU and RTP, in which all customer hours are designed to reflect short term wholesale market prices and pass through spot market prices, are more likely to be of questionable value and may pose significant bill impacts on limited income customers. Very little research has been done on the widespread costs, bill impacts, usage patterns, and system benefits of these programs, yet they are being widely discussed and promoted in many states.

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WHY ARE "SMART METERS" BEING PROMOTED AND WHO IS PROMOTING THIS CHANGE IN HOW ELECTRIC SERVICE IS PRICED?

When the U.S. Congress enacted the Energy Policy Act of 2005,[6] most observers focused on the provisions that contained directives for energy efficiency, renewable resources, tax breaks and initiatives for coal, oil, and nuclear energy, new federal authority to ensure more reliable transmission systems, as well as the repeal of the Public Utility Holding Company Act of 1935. But buried in Subtitle E of Title XII (Electricity) are several amendments to the Public Utility Regulatory Policies Act of 1978 (PURPA). Sections 1251, 1252, and 1254 of the 2005 Energy Policy Act amend the "Retail Regulatory Policies for Electric Utilities (Title I) of PURPA by adding new federal policies[7] that are applicable to state regulation of electric utilities. Section 1252 contains a new "smart metering" standard. The standard requires that each electric utility offer to each of its customer classes and to individual customers upon request a "time-based rate schedule under which the rate charged by the electric utility varies during different time periods and reflects the variance, if any, in the utility's costs of generating and purchasing electricity at the wholesale level." The time-based schedule "shall enable the electric consumer to manage energy use and cost through advanced metering and communications technology...."

The statute also sets forth the types of time-based rate schedules that may be offered, including "time of use pricing (TOU)" in which prices are broken into two or three time periods and are fixed for some period, but which may change twice per year; "critical peak pricing" (CPP) in which TOU pricing is used except for a few hours per year in which the utility can increase peak prices to a substantially higher level to reflect wholesale market conditions; "real time prices" (RTP) in which prices are provided to the end use customer to reflect the actual or real wholesale market conditions on an hourly or daily basis, typically with a very short

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notification of forthcoming price changes; and the use of credits for customers with large loads who enter into pre-established peak load reduction agreements that reduce a utility's planned capacity obligations.[8]

Under PURPA, the federal government appears to directly regulate or set standards for electric utilities. But, another section of PURPA defers to state authority over retail electric service and requires state regulators to "consider" the federal standards within one year of the enactment of the federal standard and complete the determination of its consideration within two years of the enactment of the federal standard, i.e., August 2007 based on the 2005 Energy Policy Act's enactment date.[9] If the state does not complete its determination within this time frame, PURPA then requires the state to consider and determine the federal standard at the time of the utility's next base rate case. A state can avoid any new determination entirely if it has already implemented the standard or a comparable standard, if the state regulator has considered the same or comparable standard within the previous three years before enactment, or the state's legislature has voted on the implementation of the standard or a comparable standard within the previous three years before enactment. The apparent reason for the ultimate deference to the states is that regulation of such matters traditionally is a matter of state concern and has not been preempted. Indeed, the PURPA requirement that a state must consider the original PURPA agenda was narrowly upheld by the Supreme Court in a divided opinion.[10]

The result of the new amendments and the PURPA language is that there is now a clear federal standard that supports "smart meters" and the exploration of the new pricing methods such as TOU, CPP, and RTP for all customer classes. While state regulators and nonregulated (electric cooperatives or publicly owned) electric utilities are not required to offer all customer classes the option of these new meters and alternative electric pricing methods, the fact that states are required to conduct an analysis of these options means that the proponents of this new federal policy will be eager to participate in state proceedings and argue for these policies and programs. Whether representatives of residential customers generally or limited income and payment troubled customers will be at the table is a legitimate concern.

Why do the proponents of smart meters, TOU, CPP, and RTP push for these changes in the way electricity is priced? At its core, the simple explanation is that economists believe that prices for resources should be set so that those who consume the resources will reflect when the resource is scarce and when the resource is plentiful. Under the classic economic theory, a scarce resource should reflect a high enough price to drive the providers of the resource to invest in new capacity or find a new way to satisfy customer wants and needs through technological innovation or substitution of another product. When electricity is priced to reflect the average cost of all the generation units and all the times of day in which electricity is used, the impact of the most expensive generating unit and the time of day when prices are higher due to the highest level of demand (the peak), is not seen by end use customers. Proponents say they do not see the "real" price of electricity and cannot make decisions about their usage to reflect the peaks and valleys in electricity prices. Under this theory, consumers who see the "real" price of electricity will alter usage patterns or reduce usage during the most expensive periods. Alternatively, those who must use electricity at the most expensive times will pay the "real" price and investors in new generation facilities will see the potential for profits if new generation is produced to serve this need. When generation unit prices and times are averaged, those who need to see the potential for a profit on new merchant power investment may not be paid enough to generate such investment. When a vertically integrated utility sees that it is paying higher prices for running less efficient peakers in more hours, or that capacity reserve margins are shrinking, it may take those price and reliability signals into account and may build new capacity, or take other action to reduce load, through DSM programs, or shift peak usage through rate design changes. In contrast, most end users lack power to address a peak price signal by building a new baseload plant.

This economic theory has been used in the context of electric utility regulation for many years, and there are many instances of time of day or seasonally differentiated rates under conventional regulation in states that do not have spot markets. The full import of this approach was muted with traditional regulation in which the utility was allowed to recover the costs of higher priced or more expensive generation and average that price with lower cost generation in its total generation portfolio. However, in jurisdictions where restructuring occurred, many utilities no longer own generation and they rely almost exclusively on the wholesale market for generation. Regulators are now allowing those wholesale prices to be passed through to retail customers, after transitional retail rate freezes or price caps expire. In the restructured states, an independent owner of generation without long term contracts that assure recovery of costs and a return of and on capital may not be able to recoup the costs of new generation and make a profit if it depends on selling in spot markets, all of which have constraints on charging very high scarcity prices at key peak periods.

This promotion of new metering technology and alternative pricing methods for electricity service also resonates with those who seek to make sure that prices are set to reflect the costs that are caused by the particular customer class or sub-class. For example, these proponents argue that if the reason why peak usage occurs is primarily due to residential and small commercial usage late in the afternoon or early evening, those customer classes should pay the higher prices associated with that usage. If a large commercial or industrial customer can shift usage to off peak periods or operate a night shift to make their widgets, they should pay the lowest price for electricity. Some refer to this as a reduction in "cross subsidies" which can occur between different customer classes and within a customer class, if total revenue from one of the classes does not cover the incremental cost of serving them.

Other proponents of smart meters and new pricing methods also suggest that these innovations allow utilities and other market participants to better manage the electricity grid to make more electricity available at certain key times or reduce the need for investment in new transmission or generation facilities. This can be accomplished by monitoring usage patterns in greater detail and taking actions at the wholesale level to assure that the transmission system and the dispatching of various generation units is more closely matched to actual need or used as a means of triggering interruption programs or events to prevent blackouts and reduced reliability generally. These programs are typically called "demand response" programs because they are intended to target the reduction in demand or a shift in demand usage in response to peak prices and wholesale market conditions. In states where vertically integrated utilities still own generation, new generation, transmission, or demand response mechanisms, or a combination of them, can be used in conjunction with rate design changes to achieve the desired level of system efficiency and balance of supply and demand.

Finally, proponents of smart meters and new pricing methods emphasize the potential for improved customer service by allowing the utility to read meters remotely (and eliminate meter readers and the issuance of estimated bills) and issue accurate bills, program new billing changes and pricing options into meters and offering these optional programs to customers, detect and respond to meter tampering and energy theft, and improve collection activities by allowing meters and services to be remotely started or disconnected without premise visits or personal contact at the customer's residence. Data mining of such electricity usage data could indicate when customers get up in the morning, whether they use electricity during working hours, when they leave and return, whether and when they use significant air conditioning or other motors, whether they are home weekends, whether they have been terminated for nonpayment, when they take vacations, etc. Utility handling of customer usage data has been considered in telecommunications regulation, with the general result that customer proprietary network information (CPNI) obtained by the utility as a result of the customers usage generally is to be protected from release to any third parties, and must not be released without consent, subpoena or warrant. Privacy implications from gathering customer real time electricity usage data are largely ignored and need to be addressed.

The following quotes and excerpts from national publications reveal a wide ranging support for the installation of smart meters and, more importantly, the more volatile pricing methods that will be possible as a result of the new metering and communication systems:

- Rates that are based on highly averaged costs blur the price signals to customers, and result in an inefficient allocation of resources, referred to by economists as "deadweight loss" to society. These deadweight losses have been well known for many years but there is still a need to "break away from uniform rates and substitute rates based more accurately on cost." The benefit of smart metering is that it makes it more feasible to price electricity at its real cost through time. This, in turn, can lead to the elimination (or, more realistically, the reduction) in deadweight losses, thereby promoting social welfare.[11]

- In response to a question concerning moving to an energy-only pricing in the wholesale market and eliminating locational marginal pricing, "We can get rid of every bit of that tomorrow, if every state will allow the full floating price every five minutes to be reflected in the customer's bill." Further, "Up and until the time that states will allow retail customers to see the real-time prices, and pay the real-time prices, you're forced to create square-peg/round-hole solutions; to create surrogates for scarcity pricing."[12]

- The automated collection of advanced or "interval" energy use data is necessary to enable energy market participants to more closely match energy supply with demand. Balancing energy supply and demand will become increasingly important to making the new competitive energy marketplace work in a cost effective and reliability manner. By collecting more advanced metering data, a utility can build a body of knowledge to develop an entirely new portfolio of dynamic rate structures and incentive programs, real-time pricing packages and interruptible rates that can be targeted to specific customers to significantly improve load management capabilities and reduce peak demand when distribution system conditions become critical.[13]

- With the appropriate remote control technology, the utility—via the call center—will be able to process connect and disconnect requests the same day, and without a truck roll. Further, delinquent accounts can be monitored and address—and service disconnected—without lag time between service order generation and its execution at the customer location. This ability to connect and disconnect remotely while reducing the required number of truck rolls has the ability to significantly reduce these operating costs.[14]

- The Demand Response and Advanced Metering Coalition emphasizes the importance of "customer control over their energy bill" in promoting smart meters and new pricing programs. DRAM states that residential customers "are better at managing their energy budgets; they have what economists call a higher price elasticity of demand" and such customers "deserve the same chance to lower their bills as businesses."[15]

- At the present time, because of price caps and rate protocols, prices don't rise high enough to provide adequate signals. It's always a good idea to provide consumers with better price signals, so they can increase or decrease consumption accordingly. But if you give consumers prices that are wrong or too low, they won't react to those prices. Until you integrate the system-operation protocols with prices and demand-response system, you won't get the incentives you need.[16]

- Although demand response programs can provide benefits, they face three main barriers to their introduction and expansion: (1) state regulations that shield customers from short-term price fluctuations; the absence of equipment installed at customers' sites required for participation; and (3) customers' limited awareness of programs and their potential benefits.[17]

Implicit in real time pricing strategies is a shift away from the longstanding traditional utility responsibility, still incorporated in the statutes of most states, to provide adequate service upon demand at reasonable, predictable prices, and toward a new regime in which utilities and regulators expect customers to react to system inadequacies or deficiencies by using less or paying more.

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The Federal Energy Regulatory Commission (FERC) has completed a recent survey of all states in the use of smart meters, alternative pricing methods, and demand response programs.[18] Based on the results of this survey, FERC reported that there is only a 6% penetration of advanced metering on a national level, but the penetration rate for such meters varies by type of utility and region. For example, 13% of the rural electric cooperatives have installed advanced meters. The highest level of advanced meter installation occurs in Pennsylvania, Wisconsin, Connecticut, Kentucky, Idaho, Maine, Missouri, and Arkansas. Nationally, only 5% of customers are on some form of time-based rates or incentive-based rates that relate to peak usage periods.

FERC has stated its desire to promote and encourage demand response programs and the wider use of advanced meters. In this Report, FERC identified the following regulatory barriers to increased use of demand response and peak pricing programs:

- There is a failure to link wholesale markets and wholesale prices with how retail prices appear on customer bills.
- Utilities have disincentives to promote demand response generally because it may reduce utility sales and its revenues and profits are linked to selling more electricity.
- There is no clear policy concerning the incentives to stimulate utility investment in advanced meters and new communication and data management systems and cost recovery mechanisms have not yet been resolved.
- The business case to demonstrate that benefits exceed the costs for the widespread installation of advanced meters, new communication and data management systems has not yet been made.

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- There are State-level barriers to more widespread adoption of demand response programs and the use of some pricing methods in the form of state law and policy that protects some customers from being exposed to volatile prices.
- There is not yet a resolution of how to link the wholesale markets to retail rates and prices, specifically the difficulty in linking actions taken by retail end use customers with wholesale market payments.
- The third parties or new market participants who seek to promote advanced meters need more assurance of longer term funding to expand their ability to market and produce the new meters and communications software.
- There is insufficient market transparency and access to data on prices in the wholesale market.
- There is a need for better coordination of federal-state jurisdictions to coordinate policy initiatives between the retail and wholesale markets.

Implicit in FERC's analysis is an assumption that wholesale spot market prices are a correct economic signal. Many economists would identify marginal <u>cost</u> as an appropriate pricing signal, but the wholesale markets are based on sellers' demands, not their costs. FERC apparently assumes that spot market prices approach incremental cost, but that assumption is not universally accepted. There is a growing body of academic and technical study showing that auction pricing of goods such is highly susceptible to market manipulation and overcharging.[19] If spot market prices are inflated due to strategic bidding, or are subject to manipulation, or for other reasons do not reflect incremental cost, as many contend, then the price signals for end use customers will be incorrect. Closing manufacturing plants, sending shifts of workers home on hot days, inefficient investment signals, or subjection of low income households to considerable hardship and suffering all could flow from unthinking transmission of deeply flawed spot market price signals to end use customers.

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CALIFORNIA SMART METER PROGRAM: A SYSTEM WIDE INVESTMENT AND COMMITMENT TO ADVANCED METERS, ALTERNATIVE PRICING OPTIONS, AND DEMAND RESPONSE PROGRAMS

While there is little "progress" as yet made in the widespread installation of smart or advanced meters and the use of more volatile pricing methods for residential customers, no State has taken more dramatic steps than those undertaken or planned in California. The State's Energy Action Plan identifies several key action items with regard to Demand Response, including the proposals to adopt advanced metering by the large electric utilities, educate Californians about the time-sensitivity of energy use and how they can participate in demand response programs, and incorporate demand response appropriately and consistently into the planning protocols of the California PUC, the California Energy Commission and the wholesale market administrator. As early as 2001, California had already rolled-out interval meters for large customers with usage in excess of 200 kW and the placement of those customers on time-of-use tariffs. Starting in 2003, the investor owned electric utilities were ordered to develop new demand response programs and tariffs for customers as well as expand existing emergency triggered programs. At the same time, California adopted an aggressive long-term dynamic pricing goal for the utilities equal to 5% of the projected system peak demand in 2007.

In a Report[20] to the California Legislature by the California Energy Commission in October 2003, these potential adverse impacts of real-time, critical peak, and other dynamic pricing scenarios on some customers were noted:

> Dynamic pricing can more accurately charge customers for their cost of service than do existing fixed rates. As a result, customers subsidized under current rates are most likely to pay more under dynamic pricing. In particular, any customer that uses more energy during peak periods than the average customer, and who cannot or will not shift their usage in response to price signals, is likely to pay more under dynamic pricing. Most customers should not be protected from paying the real cost of purchasing and delivering

electricity to their homes. Truly "disadvantaged" customers, i.e., low income and medical necessity customers could be provided with an explicit subsidy if the dynamic rates actually result in higher bills for them.

A fixed monthly charge for interval meters may increase bills for some low-usage customers. Options to ensure protection of these customers include the following:

- Require that the costs of new interval meters be recovered through volumetric energy rates rather than fixed charges.
- Provide customers below a certain usage level with a credit or subsidy.
- Do not provide interval meters to low-usage customers.

In this Report, the California Energy Commission also challenged the notion that low use or low income customers would necessarily be harmed by dynamic pricing. Using a simulation analysis, the Commission analyzed the impact of a 5 percent shift in usage from on to off-peak and another scenario with no shift in usage for customers using less than 350 kWh per month and reported that the resulting average monthly bill would be at least $1.00 lower under critical peak pricing compared to existing standard rates (which, in California, are already tiered to reflect significantly higher prices for increased usage). At the time of this Report, the Commission reported that the range of costs and benefits for installing the necessary advanced metering and communication systems for California's investor owned electric utilities ranged from a net benefit of $6.91 per meter per month to a net cost of -$2.45/meter/month.

In 2003-2004, California conducted statewide pilot programs for residential customers and tested a variety of pricing and demand response options.[21] Customers were solicited to participate in the program based on geographic and demographic diversity. Specifically, three pricing options were tested: (1) a traditional TOU where the price during the peak period was 70% higher than the standard rate and about twice the value of the price during the off-peak period; (2) a CPP tariff in which the peak period price during a small number of critical days was

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about five times higher than the standard rate and about six times higher than the off-peak price, but with a fixed critical period and day ahead notification; and (3) a CPP tariff similar to (2), but where the peak period on critical days was variable. The Commission had approved the pricing pilots with certain constraints, namely,

- experimental rates had to be revenue neutral for the class-average customer over a calendar year,
- the rates could not change the bill of low and high users by more than 5% in either direction, and
- participating customers must be provided with the opportunity to reduce their bills by 10% if they reduced or shifted peak usage by 30%.

These constraints resulted in using rates that would rely on a high price ratio in the summer and a low price ratio in the winter so that the annual revenue neutrality obligation could be met. Finally, it is important to consider that low income electric customers in California are already provided a 20% rate discount under the CARE program. The CARE program of low income discounts is funded through the Public Benefits Charge by all customers and is available to customers with household income of 175% of federal poverty guidelines or less. The penetration of this program among eligible low income households is very high among all California utilities, and over 90% at Southern California Edison.

The evaluation of these pricing programs for residential customers found that the use of TOU prices alone reduced consumption by 6%, but the authors noted that this may be due in part to the "modest" nature of the differential in the pilot TOU prices between peak and off peak periods. Indeed, the impact of time of use rates on residential consumption in general "almost completely disappeared" by the second year. However, the use of CPP or critical peak pricing reduced usage on Critical Peak days by 13-16%, thus showing that those customers with the largest energy usage (particularly those with central air conditioning) could have a potentially significant impact on usage during expensive peak periods. Finally, the pilot programs found that usage reduction (27%) significantly improved with installation of "smart thermostat," that is, the use of a module in the customer's home that enabled the customer or the utility to program cooling usage based on network conditions. However, since California law appears to prohibit the use of CPP for residential customers on a mandatory basis[22], it is not clear how these results can be translated into system-wide cost effective programs at this time.

Most importantly for the implications of such pricing methods for limited income customers, the impact evaluation of the California Statewide Pricing Pilot found that "the elasticity of substitution for CARE [low-income discount] customers is essentially zero."[23]

All of California's investor owned electric utilities have filed proposals for the installation of advanced meters and associated communication systems throughout their service territories with the California PUC. In July 2006, California PUC approved PG&E's proposal to replace all electric and gas meters with "smart meter" technology over five years at a price tag of $1.6 billion.[24] This initiative (and the similar plans proposed by Southern California Edison and San Diego Gas & Electric that are still pending before the PUC) is a direct result of a statewide policy to rely on smart meters and demand response programs to reduce peak load in an attempt to reduce electricity prices and the need to construct expensive new generation facilities. However, the PUC's decision did not mandate that residential customers take electricity under a demand response tariff. Rather, TOU price plans will continue to be available on a voluntary basis to such customers. The Commission stated its objective to promote TOU pricing for residential customers and will require ratepayers to fund education programs to this end in

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addition to the cost of the meters and ancillary communication and data management systems. It should be noted that current California law prohibits the use of Critical Peak Pricing for residential customers, but the PUC also approved a new voluntary CPP price option that will be offered to residential customers for certain summer peak usage hours. This CPP tariff is likely to price electricity as high as 60 cents/kWh during certain summer peak afternoon hours.

The new meters were evaluated as beneficial over a 20-year pay back period and the PUC rejected the arguments of the primary consumer intervener that the proposed level of investment and type of meter architecture proposed by PG&E was not cost effective for the residential class and that a more modest and targeted investment should be approved at this time. However, the Commission acknowledged that the primary benefits identified in the proposal were not related to demand response savings, but savings related to the use of remote meter reading, remote connection/disconnection, and outage management. The Commission's analysis also relied heavily on the proposed CPP option to have an impact on actual demand reduction during peak periods. The Commission found that 90% of the costs associated with the metering initiative would be recovered through operational savings and only 10% through demand response benefits.