CONSUMER ELECTRONICS ASSOCIATION®

Unlocking the Potential of the Smart Grid – A Regulatory Framework for the Consumer Domain of Smart Grid

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EXECUTIVE SUMMARY

The Consumer Electronics Association (CEA) and its member organizations believe that smart grid technologies will revolutionize the way Americans understand and manage energy consumption. The most efficient untapped energy resource may be energy efficiency achieved through demand response. In studies conducted by the Federal Energy Regulatory Commission (FERC), technology-enabled demand response has the potential to reduce peak demand consumption by 188 GW nationally in 2019 – a 20% reduction in estimated peak demand. These reductions can alleviate the need for additional energy generation and allow the country to achieve many of its energy goals.

Consumer-driven demand response will not happen without fundamental changes in the way consumers participate in the energy marketplace. CEA believes that in order for demand response to succeed, policymakers need to address at least two issues:

1. Consumers must be provided the economic incentive to reduce peak demand through **dynamic pricing programs**, and
2. Consumers and their third party smart grid providers must have access to **real time consumption and pricing information** in a format they can use.

These changes will require a coordinated effort by federal and state regulators, utilities, third party smart grid providers and consumers. These policy shifts will unlock the vast potential of the smart grid. CEA further believes that these changes are necessary to incent manufacturers to develop and market enabling technologies that will empower consumers to take control over their energy consumption.

Dynamic Pricing Programs. Current rate structures do not provide consumers the right economic incentives to reduce consumption during peak hours. Retail rates must track the actual marginal cost of providing electricity. Empirical studies show that consumers (i) will shift or curb consumption if given the right economic incentives to do so, and (ii) will invest in enabling technologies to assist in automating their responses to these economic incentives. To foster the development of technologies that will enable demand response, CEA encourages policymakers to:

- Work with utilities, smart grid providers and consumers to consider ways to expedite the transition to dynamic pricing;
- Encourage utilities to coordinate with the consumer electronics industry when planning demand response deployments;
- Modify existing weatherization and demand side management incentive programs to include smart grid technologies; and
- Consider the enhancement of existing market-oriented programs and the creation of other programs to encourage the adoption of smart technologies (e.g., home area networks (HANs) and home energy management systems (HEMs)) that enable consumers to act on dynamic pricing and real time energy information.

Open and Non-Discriminatory Data Access Rules. Success in the customer domain of the smart grid can be promoted by granting access to consumption data to consumers, to consumer equipment, and to third parties authorized by consumers. Open and non-discriminatory data access rules will help preserve the competitiveness of the home energy marketplace and will lead to innovative solutions that we cannot even imagine now. Policymakers should consider the following principles when adopting smart grid data access and privacy policies:

- Data access and privacy policies should be **broadly focused**;
- Data access policies must be **open and non-discriminatory**;
- Distribution utilities **should make enhanced consumption data** available to consumers and their autho-

rized third party providers;

- Consumers and their third party smart grid providers should have **access to raw data** generated by the smart grid;
- Utilities should be encouraged to **accelerate the accessibility** of energy consumption and pricing data;
- Delivery of consumption and pricing data must be in **real-time**;
- Consumer consent mechanisms should be **simple, clear and electronic**;
- **Consumers own their consumption data** and they (and third party smart grid providers) should **not be charged for access** to this data;
- Data access **rules should specify a minimum amount of consumption data that utilities must collect** and make available to consumers and their authorized third party providers;
- Data access rules should **not place unreasonable limitations** on the companies or devices that can access consumption data; and
- Data access and privacy policies should **recognize consumers' right to privacy** in their energy usage information and give consumers the ability to make informed decisions about utility and third party access to this data.

CEA believes that these policy changes are essential to the success of the smart grid and encourages close coordination among the various stakeholders during the transition to the next generation of the grid.

ABOUT CONSUMER ELECTRONICS ASSOCIATION

The Consumer Electronics Association (CEA) is the preeminent trade association promoting growth in the $186 billion U.S. consumer elec¬tronics industry. More than 2,000 companies enjoy the benefits of CEA membership, which include legislative advocacy, market research, technical training and education, industry promotion, stan¬dards development and the fostering of business and strategic relationships. CEA's members include some of the leading producers of consumer facing devices and technologies that allow consumers to become more energy efficient and environmentally aware. CEA also sponsors and manages the International CES — The Global Stage for Innovation. All profits from CES are reinvested into CEA's industry services. Find CEA online at CE.org.

INTRODUCTION

As the Department of Energy (DOE) has emphasized, "[t]he promise of the Smart Grid is enormous and includes improved reliability, flexibility, and power quality, as well as a reduction in peak demand and transmission costs, environmental benefits, and increased security, energy efficiency, and durability and ease."[1] One of the "most important and cost-effective ways to meet national energy goals is to encourage energy efficiency in homes and businesses."[2] Unleashing innovation within homes and businesses means that consumers' relationships with energy providers and their role in the energy marketplace must fundamentally change.

In the traditional energy model, consumers are passive recipients of energy. They expect the lights to turn on and the dishwasher to work. Their interactions with their energy providers amount to the payment of a monthly bill based on fixed monthly rates. Consumers have little insight into this bill or how their day-to-day activities impact it, and few realize that the fixed price they pay has little to no correlation to the marginal cost of providing this electricity.

As we upgrade the supply side of the electrical grid through the installation of smart devices and other smart grid technologies, we must likewise modernize the demand side and consumers' roles in the energy marketplace. Smart grid technologies give consumers the tools to actively participate by controlling their consumption, enabling them to store electricity through plug-in electrical vehicles and generating their own energy through solar panels. As noted by Greentech Media, the smart grid is often labeled "the enabler of the new energy economy."[3]

The reason for this is — as we saw in the Internet revolution — that more information not only leads to better decisions, and better business outcomes, but fundamentally unleashes a broader spectrum of commerce. Not only will consumer energy data be transformed into actionable intelligence, allowing homes and businesses greater efficiencies and greater cost savings (largely through automation and demand response programs), but this participatory network will also allow end-users to perform countless new actions, including becoming sellers of energy as distributed generation and distributed storage become increasingly cost-effective solutions. Essentially, this is the smart grid revolution.[4]

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[1] Implementing the National Broadband Plan by Empowering Consumers and the Smart Grid: Data Access, Third Party Use, and Privacy, Department of Energy, *Request for Information*, FR Doc. 2010-11127, 75 Fed. Reg. 26203, 26203 (May 11, 2010) [hereinafter Data RFI].

[2] Federal Communications Commission, Connecting American: The National Broadband Plan 271 (Mar. 2010) [hereinafter National Broadband Plan].

[3] David J. Leeds, Greentech Media, *The Smart Grid: What Comes Next?*, SEEKING ALPHA (June 14, 2010), http://seekingalpha.com/article/209986-the-smart-grid-what-comes-next.

[4] *Id.* Other consumer benefits of DR include: (a) "Reduction of electricity prices by encouraging more efficient purchasing behavior and moderating the exercise of market power;" (b) Customers gaining an understanding of their usage patterns, "allowing them to make rational decisions to purchase more electricity, generate their own, or invest in energy-efficient equipment;" (c) "Dynamic tariffs better reflect the actual cost-of-service, allowing more equitable distribution of costs across customers and customer

Smart technologies will play a critical role in this transformation. Home energy management systems, that may include displays, devices, two-way programmable thermostats, and smart appliances, can take pricing signals and consumer preferences and translate them into actionable decisions without constant consumer oversight. But this market will not achieve its true potential without needed policy changes. Consumers currently have little economic incentive to reduce or shift their consumption and, as a consequence, see little value in home energy management solutions. At least two policy changes must occur. First, utilities and state regulatory commissions should consider implementing dynamic pricing programs that closely tie real time wholesale prices to the retail prices that consumers pay. Second, consumers and their authorized third party smart grid providers must have easy, real-time access to energy consumption and pricing information so that they can understand and take control of their consumption. These authorized third party smart grid providers could include consumer electronics companies, appliance manufacturers, telecommunications companies, cable companies, fixed and mobile wireless operators and entrepreneurs. Without these policy modifications, the potential of demand response will not be achieved.

WIDESPREAD IMPLEMENTATION OF DYNAMIC PRICING PROGRAMS

The long-term success of the smart grid depends on a nationwide transition to dynamic pricing for electricity. Dynamic pricing will incent consumers to reduce consumption and encourage innovators to develop products and services that will automate consumers' responses. While some consumers will reduce or shift consumption to lessen their burden on the environment without economic incentives, most consumers need to see an economic benefit before purchasing smart grid-enabled devices.[5] As noted by District of Columbia Public Service Commissioner Rick Morgan, "[w]ithout dynamic pricing, we will forego some of the greatest benefits of the smart grid. . . . There's no point in having smart meters if you are still going to have dumb rates."[6]

What is Meant by Dynamic Pricing?

Under traditional utility rate regulation, retail electric prices are set based on the average cost of providing electricity to consumers. Flat prices do not take into account the marginal cost of providing electricity at any given time.[7] They create a discrepancy between average cost and marginal cost is most pronounced during periods of peak demand where the marginal cost of providing power substantially exceeds the average cost charged to consumers. This spread can lead to an "inefficient overconsumption of electricity during the peak, and inefficient underconsumption during the off-peak."[8] It forces utilities to build power plants solely to serve demand during peak periods,[9] and increases the risk of system outages during peak demand periods where the utility is unable to generate sufficient supply to meet demand.[10]

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classes;" and (d) "Unlike conventional load control or curtailable/interruptible incentives, dynamic tariffs can be made available to all customers, regardless of overall usage level or appliance ownership." CALIFORNIA ENERGY COMM'N, FEASIBILITY OF IMPLEMENTING DYNAMIC PRICING IN CALIFORNIA 11 (Oct. 2003).

[5] Accord ASSOCIATION OF HOME APPLIANCE MANUFACTURERS, THE HOME APPLIANCE INDUSTRY'S PRINCIPLES & REQUIREMENTS FOR ACHIEVING A WIDELY ACCEPTED SMART GRID 8 (Dec. 2009) (quoting Mert, Wilma, et. al., *Consumer Acceptance of Smart Appliances*, Smart Domestic Appliances in Sustainable Energy Systems (Smart-A) (Dec. 2008)) ("There are two main reasons why consumers will adopt smart appliances: either to gain an economic benefit or to contribute to reduce the environmental burden. As the results of the research show consumers clearly expect an economic benefit in order to use smart appliances. They are not prepared to change their behavior without good incentives. Only a small percentage of environmentalists will be ready to buy smart appliances solely for environmental reasons. Following this logic the main trigger to buy smart appliances will be attractive tariff offers of the utilities to their consumers.").

[6] Rick Morgan, Rethinking 'Dumb' Rates, PUBLIC UTILITIES FORTNIGHTLY 35, 35 (Mar. 2009).

[7] For a discussion of the history of electricity pricing, see Lee S. Friedman, *The Importance of Marginal Cost Pricing to the Success of Greenhouse Gas Reduction Programs*, presented at the Annual Research Conference of the Association of Public Policy Analysis and Management, Washington, DC, 3 (Nov. 6, 2009), available at http://gsppi.berkeley.edu/faculty/lfriedman/MC%20Electricity%20Pricing%20and %20GHG%20Reductions%201.0 1.pdf.

[8] *Id.*

[9] See id.; JONATHAN KOOMEY & RICHARD E. BROWN, LAWRENCE BERKELEY NATIONAL LABORATORY, THE ROLE OF BUILDING TECHNOLOGIES IN REDUCING AND CONTROLLING PEAK ELECTRICITY DEMAND 1 (Sept. 2002), *available* at http://enduse.lbl.gov/projects/peakdemand.html.

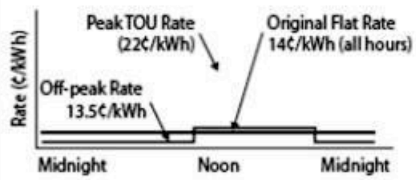
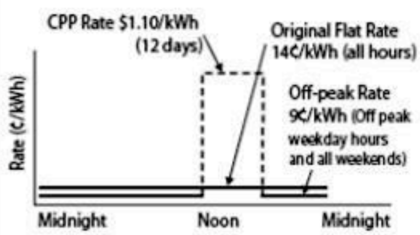
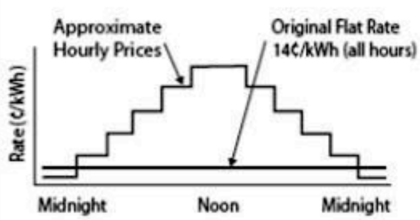
[10] *Id.*

Dynamic pricing may remove "hedge premiums" designed to protect utilities from price volatility in the wholesale markets.[11] Additionally, dynamic pricing could reduce the risk of regressive cross-subsidies that benefit those that overconsume during peak hours.[12] It also more closely aligns retail rates with the marginal cost of providing electricity at any given time.

There is a spectrum of pricing plans that are more "dynamic" than average cost pricing ranging from (in order of increasing time variance): time of use (TOU); critical peak pricing (CPP)/critical peak rebate or peak time rebate (CPR); and hourly pricing/ real time pricing (RTP).

- TOU Pricing. Consumers are generally charged two flat rates: off-peak and on-peak. The peak price is some multiple of the off-peak price. TOU rates are not truly "dynamic" because they are not dispatched in relation to changes in actual wholesale market prices.[13]
- CPP Pricing. Consumers receive a slight discount on rates throughout the year but are charged a significantly higher rate during critical peak periods (between 60-200 hours a year).[14] In the PowerCents-DC™ program pilot described below, for example, CPP rates were approximately $.64 per kilowatt hour more than regular rates. Thus, if consumers shift their electricity usage from more expensive to less expensive hours under CPP plans, they can reduce their electricity costs.[15]
- CPR. CPR is the inverse of CPP in that consumers are rewarded for consumption reductions during peak periods. CPR customers maintain their flat average cost rates but receive a cash rebate for each kWh they reduce during critical peak hours. Under CPR, "no customer can be charged more than they would be on corresponding flat rate if they do not respond, but customers who do respond can save on their monthly bill."[16]
- Hourly Pricing or RTP. RTP is the purest form of dynamic pricing of these plans. Retail rates are linked to the wholesale cost of providing such electricity. These prices are generally set on an hourly basis, based on the prices in the "day-ahead" wholesale market.[17] Each rate plan is graphically illustrated on the next page:

[11] See Morgan, supra note 6, at 36.
[12] Commissioner Paul A. Centolella, Public Utilities Commission of Ohio, *Smart Pricing: The Key to Smart Grid Benefits*, Presentation at GridWeek 2010 (Oct. 18, 2010).
[13] AHMAD FARUQUI, SANEM SERGICI, & JENNIFER PALMER, THE IMPACT OF DYNAMIC PRICING ON LOW INCOME CONSUMERS, IEE WHITEPAPER 5 (Sept. 2010) [hereinafter IEE WHITEPAPER].
[14] EMETER CORP., POWERCENTSDC™ PROGRAM FINAL REPORT 2 (Sept. 2010), available at http://www.powercentsdc.org/ESC%2010-09-08%20PCDC%20Final%20Report%20-%20FINAL.pdf [hereinafter POWERCENTSDC REPORT].
[15] IEE WHITEPAPER, *supra* note 13, at 5.
[16] *Id.* The IEE Whitepaper noted a number of drawbacks to CPR. First, it requires the utility to establish a baseline load for each customer. Second, consumer education for CPR can be challenging because consumers are not being charged more for energy per se. *Id.* With CPR, "customers who don't respond by shifting load wind up paying the rebates to those customers that do respond." *Id.*
[17] POWERCENTSDC REPORT, supra note 14, at 13.

TIME-OF-USE (TOU) RATES	• Rates increase above flat rate during pre-set daily peak periods by 100%. • The most common in the past; easy to understand, predictable, and bill impacts most moderate. However, least efficient and impactful.	
CRITICAL PEAK PRICING (CPP)	• On 12 days selected by the utility, each one day in advance, prices are raised during the peak period by ~500%. • Utility notifies customers one day in advance that peak prices will be in effect the following day. • Can also be inverted to offer peak time rebates. • More impactful than TOU rates.	
REAL-TIME PRICING (RTP)	• Prices change every hour to reflect true hourly production costs and/or market prices. • To reduce uncertainty, hourly prices are set one day in advance and made public. • Most accurate and impactful, but also most complex and volatile. Usually applied only to large customers.	

Source: Ahmad Faruqui, Sanem Sergici & Jennifer Palmer

Dynamic Pricing Will Lead to Smarter Energy Usage and Increased Energy Efficiency

Empirical evidence demonstrates that consumers will respond to pricing signals by reducing consumption during peak periods. Studies such as the recently completed PowerCentsDC™ program pilot conducted in Washington, D.C. revealed that more dynamic programs, such as CPP, elicit more significant peak demand reductions than TOU or CPR programs.[19] Participants were placed on one of three dynamic pricing programs: CPP, CPR or hourly pricing. Some participants also received smart thermostats to automate their responses to pricing signals. Results published in the September 8, 2010 final report demonstrated significant peak demand reductions.[20] For consumers that did not receive smart thermostats, CPP plans led to 29% summer peak reductions and CPR plans led to 11% peak reductions. Hourly pricing programs saw reductions of 10%.[21]

[18] See IEE WHITEPAPER, supra note 13, at 6 (citing PETER FOX-PENNER, SMART POWER, CLIMATE CHANGE, THE SMART GRID, AND THE FUTURE OF ELECTRIC UTILITIES (2009)).
[19] POWERCENTSDC REPORT, supra note 14.
[20] *Id.* at 32.
[21] *Id.* The report explained the lower reductions for hourly pricing by two factors: the high prices were not as high as CPP and the hourly pricing consumers were presented with declining average prices over the duration of the pilot. *Id.* at 31.

The Brattle Group recently reviewed fifteen dynamic pricing experiments conducted over the past several years nationwide, and their conclusions support the PowerCentsDC program results.[22] The aggregate of these experiments illustrated that TOU programs lead to 4% peak demand reduction; CPR led to 13% peak demand reduction; and CPP led to 17% peak reduction.[23]

Studies further demonstrate that coupling dynamic pricing programs with enabling technologies will increase peak demand reductions. In the PowerCentsDC program, the introduction of smart thermostats when coupled with CPP and CPR plans increased peak demand reductions from 29% to 49% and 11% to 17%, respectively.[24] The Brattle Group's review of fifteen dynamic pricing programs reached similar conclusions on the value of enabling technologies.[25]

The FERC's 2009 demand response assessment concluded that demand response (DR) based in dynamic pricing and enabling technologies could lead to significant nationwide peak demand reductions.[26] The study extrapolated aggregate peak demand reductions based on various scenarios including a base case of no DR, "business as usual," "expanded business as usual," "achievable participation," and "full participation." Each scenario analyzed assumed varying levels of advanced metering infrastructure (AMI) deployments, dynamic pricing program adoptions and enabling technology deployments. The business as usual (BAU) scenario considers demand response that would occur over the next decade through already existing and planned programs. Under BAU, FERC estimated a 4% peak demand reduction from the base case by 2019 (38 GW).[27] The "expanded BAU" scenario ports the current mix of DR programs to all states, increases

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[22] AHMAD FARUQUI & SANEM SERGICI, HOUSEHOLD RESPONSE TO DYNAMIC PRICING OF ELECTRICITY – A SURVEY OF THE EXPERIMENTAL EVIDENCE 43 (Jan. 10, 2009), *available at* http://www.hks.harvard.edu/hepg/Papers/2009/The%20Power%20of%20Experimentation%20_01-11-09_.pdf. *Accord Texas Following 'No-Regrets" Policy that Embraces Smart Grid*, SMARTMETERTODAY (Sept. 13, 2010), http://www.smartgridtoday.com/members/2037.cfm (subscription required) (citing a study that shows "when a customer is provided a smart meter, he saves 7-12%/month, but when that's coupled with [time of use pricing], the savings can go to 18-20%"). Additionally, a study conducted by Baltimore Gas and Electric showed peak demand reductions ranging from 22 to 37%, depending on the rate structure and technology employed. Baltimore Gas & Electric Comments to DOE RFI, at 2-3 (Nov. 1, 2010), *available* at http://www.oe.energy.gov/DocumentsandMedia/BGE_Comments.pdf. The report further found that "the level of customer responsiveness grew substantially from the first year of the pilot to the second, suggesting that customers became more adept over time to save greater amounts on their energy bills." Id. at 3.

[23] *Id.*

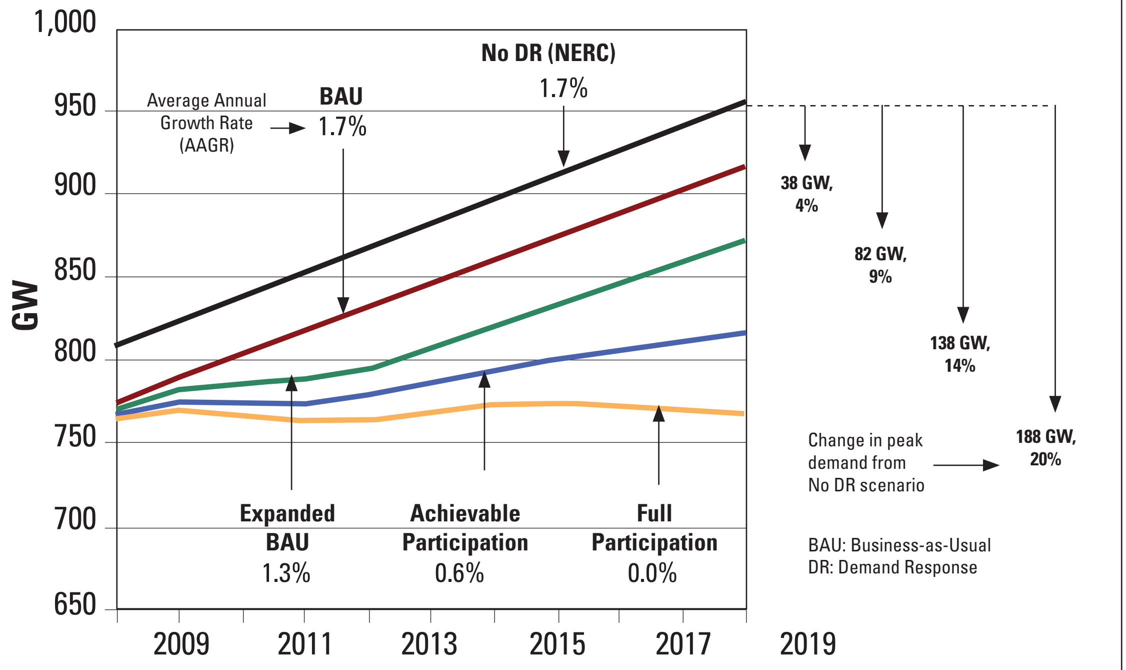
[24] *Id.*

[25] *See* FARUQUI & SERGICI, *supra* note 22.

[26] *See* FEDERAL ENERGY REGULATORY COMMISSION, A NATIONAL ASSESSMENT OF DEMAND RESPONSE POTENTIAL xi (June 2009), *available* at http://www.ferc.gov/legal/staff-reports/06-09-demand-response.pdf [hereinafter FERC DR Report].

[27] Existing and planned programs include interruptible rates and curtailable loads for medium and large commercial and industrial (C&I) customers and direct load control of residential and small C&I customers. *See id. at* xi.

participation, includes partial AMI deployment, and assumes 5% customer participation in dynamic pricing programs. This expanded BAU scenario forecasts 9% peak demand reductions from the base case by 2019 (82 GW).[28] The "achievable participation" scenario assumes universal deployment of AMI, widespread dynamic pricing tariffs (though 25 to 40% of participants could opt out of them) and alternative DR programs such as direct load control for participants that opt out. Here, the estimated reduction in peak demand by 2019 is 14% (138 GW). The "full participation" scenario is similar to the achievable participation scenario except consumers cannot opt out, and they also receive proven, cost-effective enabling technologies. Full participation could reduce peak demand by 20% by 2019 (188 GW). The peak demand reduction forecasts for each scenario are as follows:

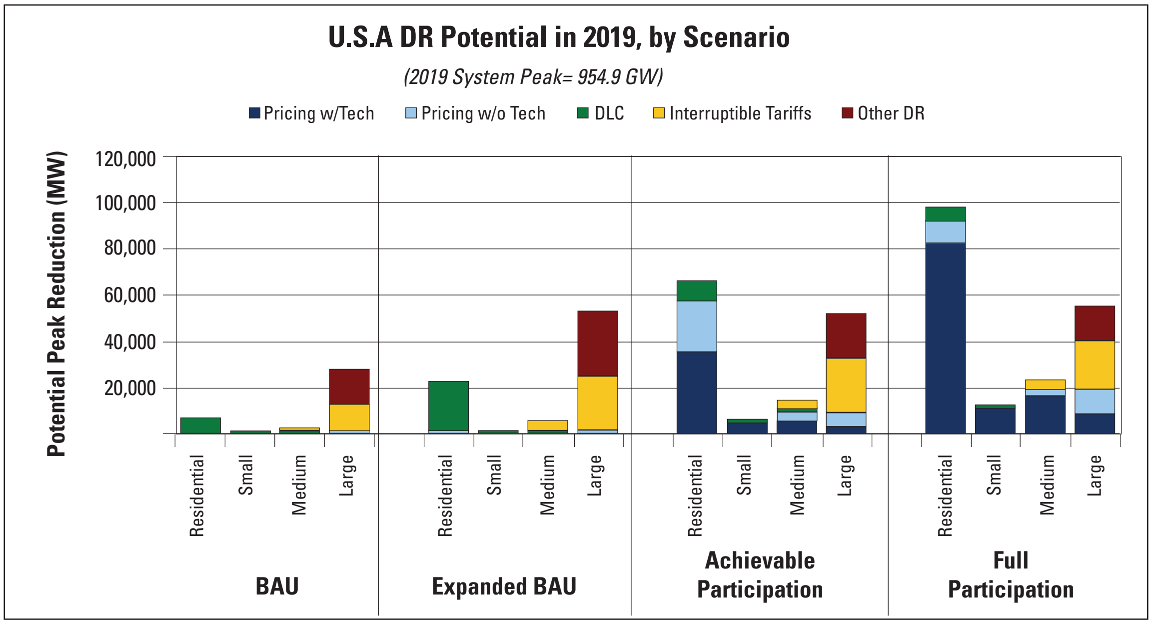


Source: FERC A National Assessment of Demand Response Potential[29]

FERC's report concluded that the nationwide introduction of dynamic pricing could increase the potential peak demand reductions by 54%, and alleviating DR and enabling technology market acceptance concerns would yield an additional increase of 33% (the difference between the achievable potential and full participation scenarios).[30]

[28] *Id.*
[29] FERC DR Report, *supra* note 26, at x
[30] *Id.*

The following chart highlights the demand response savings under each of FERC's scenarios in 2019. As demonstrated in the FERC report, dynamic pricing with technology will generate the most significant demand response savings for residential consumers under both the achievable participation and full participation scenarios. Based on its assessment, FERC staff recommended that state regulatory commissions and utilities implement dynamic pricing tariffs nationwide.[32]



Source: FERC A National Assessment of Demand Response Potential

Smart Technologies Will Help Automate Consumer Responses to Price Signals

The home energy management industry remains a nascent industry, but the products and services on the market currently highlight the potential ways that technology can help contribute to the success of demand response programs. Below are just a few examples of currently available technologies from various CEA member companies:

- Control4 Corporation: Control4 offers home automation solutions that enable consumers to control their energy consumption by remotely controlling their thermostat from any Control4 interface, and programming their shades and thermostats to automatically adjust for maximum energy efficiency (based on the seasons, time of day, or outside temperature).
- GE: GE is developing Nucleus™ Energy Manager, a smart grid-enabled gateway that will communicate with smart meters, record and store energy usage information for up to three years, and provide consumers with real time and historical energy data that can be used to understand and reduce their energy usage. This gateway will also work in conjunction with Brillion™-enabled smart appliances. In November 2009, GE began distributing a type of hot water heater that can link to smart electric meters. Now, GE's full suite of kitchen and laundry appliances, refrigerators, ranges, dishwashers, water heaters, clothes washers and dryers are currently shipping to utilities for use in smart grid demonstration projects.

[31] FERC National DR Potential Assessment, Results Viewer (June 2009), available at http://www.ferc.gov/industries/electric/indus-act/demand-response/NADR-model.xls.

[32] FERC DR Report, supra note 26, at xvi.

[33] Control4, Get Comfortable and Save, http://www.control4.com/residential/solutions/energy/ (last visited Dec. 19, 2010).

- Home Automation, Inc.: Home Automation, Inc. currently offers consumers (i) in-home displays that allow them to see their actual energy consumption in real time, estimate their bill for the month, and remotely control the air conditioner and water heater for energy efficiency; (ii) programmable communicating thermostats that allow consumers to adjust their air conditioning units; and (iii) load control modules that allow consumers to control products with large energy demands (*e.g.*, water heaters, pool pumps, etc.) according to electricity costs and schedule.
- Intel Corporation: Intel has developed a home energy control panel that acts as a hub for controlling networked appliances and thermostats and gathers information from smart meters which will enable various manufacturers to develop a range of home energy management systems. The system is based on Intel's Atom processor and can work with Wi-Fi and Zigbee wireless devices, such as thermostats.
- LG Electronics: LG offers a full line of home appliances equipped with its proprietary LG THINQ technology. LG THINQ enables consumers to manage their appliances to achieve "a big leap forward in convenience and efficiency."[36] For example, appliances can be programmed to operate at the most cost-effective times, perform diagnostics and notify the consumer of problems, download appliance updates and services like pre-programmed recipes, oversee household chores such as cook times and vacuuming, and track the quantity and expiration dates of goods in the refrigerator.
- Motorola Mobility/4Home: Motorola Mobility recently acquired 4Home, a smart grid network specialist. 4Home's ControlPoint software taps the power consumption of various appliances, delivers information about their power usage and estimated costs, and enables consumers to turn down lights and curb air conditioner operations. Motorola Mobility will integrate ControlPoint into its phones, set-top boxes and home networking equipment.[37]
- Universal Devices Inc.: Universal Devices offers an autonomous energy management and automation system that acts as a home's "operating system." The system provides native support for Open ADR, Flex Your Power, and Zigbee SEP 1.1 (field upgradeable to version 2.0) to accommodate a broad array of off-the-shelf energy management devices. The system further allows for the intelligent orchestration, utilization, generation and distribution of energy based on utilities' defined, and consumers' refined, scenarios.[38]
- Other Mobile Applications. Many applications for mobile devices have recently emerged that allow consumers to monitor and control their energy consumption remotely. Examples include Google's PowerMeter,[39] Control4 Mobile Navigator,[40] and Visible Energy's iPhone Energy UFO.[41]

If the Internet revolution is precedent, the above solutions are just the tip of the iceberg. The future will likely see converged consumer electronic devices that will not only enable consumers to control their energy consumption, but also allow them to do so via their smart televisions, mobile phones and tables and other consumer electronics devices. But until dynamic pricing programs become more widespread, the energy management market will likely remain underdeveloped as entrepreneurs, established companies and financial institutions will not commit the resources necessary to develop innovative products and services due to a lack of consumer demand.

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[34] ZPRYME RESEARCH AND CONSULTING, SMART GRID INSIGHTS: SMART APPLIANCES 20 (Mar. 2010).

[35] Martin LaMonica, *Intel Ramps Up Home Energy Push with Control-Panel Design*, CNET NEWS (Oct. 1, 2010), http://news.cnet.com/8301-11128_3-20018238-54.html.

[36] *See* LG Newsroom, *LG Unveils Total Home Appliance Solution Empowering Consumers to Smartly Manage Their Homes* (Jan. 3, 2011), http://www.lgnewsroom.com/CES2011 (last visited Jan. 6, 2011).

[37] Michael Kanellos, *Motorola Buys Home Networker 4Home: Does It Make Sense?*, GREENTECHGRID (Dec. 1, 2010), http://www.greentechmedia.com/articles/read/motorola-buys-home-netwoker-4home-does-it-make-sense/.

[38] See Universal Devices, Inc., Our Vision, http://www.universal-devices.com/company.htm (last visited Feb. 15, 2011).

[39] See Google PowerMeter, http://www.google.com/powermeter/about/ (last visited Jan. 26, 2011).

[40] See Control4, Control4 Goes Mobile; Introduces Blackberry and Droid Apps to Run the Smart Home (Jan. 7, 2010), http://www.control4.com/about-us/press/2010/01/07/mobile/.

[41] Visible Energy, In-Home Displays-iPhone Energy UFO, http://www.visiblenergy.com/products/display/iphone.html (last visited Jan. 26, 2011).

Dynamic Pricing Programs Can Equally Benefit Low-Income Consumers

Despite perceptions that dynamic pricing programs and enabling technologies could harm low-income consumers, recent empirical evidence reveals that lower income consumers will also benefit from the implementation of dynamic technology. The Institute for Electric Efficiency (IEE) recently evaluated five pricing pilots in Maryland, Connecticut, the District of Columbia, and California.[42] IEE's research indicated that low income consumers are responsive to dynamic rates and can benefit from them.[43] For example, in the PowerCentsDC program, low-income consumers saw peak consumption reductions of 11% on a CPR plan without enabling technology.[44] This was the case *even when* consumers did not ultimately shift their load to off-peak hours.[45] In IEE's bill impact simulations, the study concluded that 65 to 79% of low income consumers would benefit from dynamic pricing even without demand response load shifting because these consumers have flatter than average load shapes, in other words they use less power during peak hours. As noted by District of Columbia Public Service Commissioner Morgan, traditional blended rates tend to subsidize larger consumers with big air conditioning loads at the expense of low-income and other consumers.[46] Dynamic pricing can provide low-income consumers "a long-overdue credit for their economical use of the electrical system."[47]

Savings may also accrue even without investment in advanced home energy management technologies or services. Consumers can be informed of advantageous rate periods, critical peak periods, etc. through a variety of communications channels such as text messages, phone calls, television and radio announcements that notify them of such opportunities.

Policymakers Should Encourage the Adoption of Smart Grid Technologies

Given the interplay between dynamic pricing and enabling technologies, policymakers are encouraged to take more steps to support the adoption of smart technologies. Steps that policymakers could take could include:

- First, utilities should be encouraged to incorporate enabling technologies into smart grid pilots.
- Second, utilities should be encouraged to coordinate with the consumer electronics industry when planning demand response deployments, as the industry has insights into how to better market energy saving products to consumers.
- Third, state regulatory agencies and legislatures should modify existing weatherization and demand side management incentive programs to include smart grid technologies. These weatherization programs already support insulation, replacement windows and improved HVAC units. Smart grid technologies have been shown to provide similar savings and could be included in these existing programs. These programs if implemented should embrace consumer choice and allow consumers to select a multitude of devices and applications that lead to greater energy efficiency and peak demand reductions.
- Fourth, policymakers should consider the enhancement of existing market-oriented programs and the creation of other programs to encourage the adoption of smart technologies (*e.g.*, HANs and HEMs) that enable consumers to act on dynamic pricing and real time energy information. Any such incentive programs should be consumer-empowering by allowing them to choose technologies and not upset the competitive landscape by picking technological winners or losers.

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[42] IEE WHITEPAPER, *supra* note 13.
[43] *Id.* at 26.
[44] POWERCENTSDC REPORT, *supra* note 14, at 3.
[45] *Id.*
[46] *See* Morgan, *supra* note 6, at 36.
[47] *Id.*

REAL-TIME ACCESS TO ENERGY CONSUMPTION AND PRICING INFORMATION

The long term promise of the smart grid depends upon the creation of a framework that encourages consumers' active participation in the energy marketplace. However, providing consumers the economic incentive to shift usage to off-peak hours is just one part of the equation. Consumers must be able to understand their energy usage and innovators must be able to leverage consumption data to offer consumer-empowering smart appliances and devices. As noted in the National Broadband Plan, "[m]aking energy data available to consumers and their authorized third parties, while employing open and nonproprietary standards, is the best way to unleash [the] vast potential for innovation" in the smart grid.[48]

The dynamics of the current energy distribution system place distribution utilities in a unique position. They control the consumer relationship and are the central repository for consumption data generated by the smart grid. The home energy management marketplace, however, should be competitive. Policies should facilitate this competitiveness by ensuring that consumers and their third party providers have access to this repository of information. This access must of course be balanced to protect the consumer's privacy and maintain the security of the smart grid.

The following policy principles establish an appropriate balance between access and privacy. They also establish a regulatory framework that will transform the consumer domain into an innovative edge market with technological solutions that are beyond the current imagination. We recognize that utility regulation at the consumer level is primarily the prerogative of states. However, we encourage policymakers to adopt programs that foster national markets for demand response and home energy management products.

- **Data access and privacy policies should be broadly focused.** The relationship between the distribution utility and its consumers raises a number of significant state concerns, which each state's regulatory commission must necessarily oversee. As stewards of the public interest, regulatory commissions necessarily will consider rules by which utilities may collect, use and distribute consumer consumption data as part of any smart grid deployment. Fragmented data access laws risk the creation of multiple, inconsistent privacy, security and data access rules governing the nation's electrical distribution grid. The Smart Grid Interoperability Panel Cyber Security Working Group's (SGIP-CSWG) findings indicate that existing privacy regimes vary widely by state.[49] Ensuring that the nation can achieve both federal and state policy objectives would be facilitated by coordination among the states, utilities and smart grid providers. Inconsistent data access rules could potentially hinder the industry's ability to develop nationwide markets for smart grid products and services. A patchwork approach would not only limit the ability of consumers to take their smart appliances when they move, but it could also require manufacturers to create New York-, California-, and Georgia-specific devices. This would discourage the production of low-cost, mass-produced consumer electronics.

  We hope that state policymakers would look towards consensus-building efforts on data access, privacy and security when implementing data access policies. In many respects, the companies that already provide products and services to consumers outside of the smart grid will be the same companies that offer smart grid products and services. Additionally, smart grid providers should not be required to register with a utility or regulatory commission before receiving access to a consumer's smart meter data, but instead should only be required to demonstrate that they have received the consumer's consent to obtain it.

- **Data access policies must be open and non-discriminatory.** Non-discriminatory data access regimes are essential to the creation of an open and competitive marketplace for consumer-oriented smart grid technologies, products and services. The distribution utility hold a special position with consumers as its monopoly energy provider, but this does not entitle it to withhold consumers' consumption data

[48] National Broadband Plan, supra note 2, at 273.

[49] See SGIP-CSWG, Smart Grid Cyber Security Strategy and Requirements, Draft NISTIR 7628, at 103 (Feb. 2010), available at http://csrc.nist.gov/publications/drafts/nistir-7628/draft-nistir-7628_wnd-public-draft.pdf [hereinafter Preliminary Smart Grid Cyber Security Report].

to prevent innovation or limit competition in the consumer domain. We believe that the utility should be placed on an equal footing with smart grid providers in its use and disclosure of consumption data, apart from the use by the utility of such of such information to provide regulated services. These principles apply equally to the distribution utility and any of its "preferred" providers of smart grid technologies. Consumer consent should be required before a utility can directly or indirectly offer home energy management technologies and services, and other companies should not be precluded from offering a competitive service to those same consumers.

- **Distribution utilities should make enhanced consumption data available to consumers and their third party providers.** Data access rules should not allow utilities to refuse to make consumer's energy usage data available because it has been "enhanced" or rendered non-standard by the utility. Some utilities assert that this enhanced data is proprietary and does not need to be shared with consumers or their smart grid providers.[50] This is not the case. In most circumstances, smart grid deployments will be financed by consumers through regulated rates. The energy data generated by the grid is for the benefit of the consumers, and consumers should not be denied access to this data based on some claim that the information, once "enhanced" by the utility, becomes proprietary.
- **Consumers and their third party smart grid providers should have access to raw data generated by the smart grid.** Data access rules should allow consumer and third party access to raw real-time data in addition to data enhanced as part of the utility's normal operations. Consumers can leverage this information in real time using enabling technologies to make smart energy decisions.
- **Utilities should be encouraged to accelerate the accessibility of energy consumption and pricing data.** As part of smart grid deployments, consumers should receive the full benefits that demand response technologies offer. Enhanced features such as HAN interfaces and the ability to obtain consumption data on a real time interval basis should not be permanently locked. In most cases, consumers pay for these enhanced features through increased rates, trackers or rate riders. Policymakers should also consider consumer education programs designed to explain the value of these enhanced features as a way to limit consumer confusion and explain the benefits of these enhanced features.
- **Delivery of consumption and pricing data must be in real time.** The success of dynamic pricing programs and changes in consumers' behavioral patterns depends on real time access to consumption data and pricing information. More specifically, consumers should be able to see their energy usage and make consumption decisions in *real time*. Instantaneous access will allow consumers to see the impact of running their dishwasher, turning on the pool pump, or watching their television on their energy consumption. Even without dynamic pricing, "simply providing consumers better information about their energy use has been shown to reduce total consumption by 5–15%, equating to savings of $60–180 per year for the average American household."[51] Placing unreasonable and artificial caps on the timing of data access could unnecessarily constrain the potential market for home energy management devices.

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[50] See, e.g., Comments of Edison Electric Institute, Department of Energy Request for Information, Implementing the National Broadband Plan by Empowering Consumers and the Smart Grid Data Access, Third Party Use, and Privacy 33 (July 12, 2010), available at http://www.gc.energy.gov/documents/EdisonElectric_Comments_DataAccess.pdf (EEI argued that "[u]tilities often enhance [consumer energy usage data,] CEUD, using software programs to validate, estimate and edit raw metered data, or using decision support systems consisting of a data base, model base, and user interface. To the extent utilities enhance CEUD, neither customers nor third parties have a right to access such enhancements. These types of data are enhanced and validated by utilities for internal purposes, and utilities therefore have specific ownership rights to this data that prevent its disclosure to customers or third parties.).

[51] National Broadband Plan, supra note 2, at 272.

CEA understands that the implementation of real time data access regimes may be costly, and policymakers must ultimately strike a balance between real time access and costs to consumers. While not perfect, the California Public Utilities Commission has established a near-term solution whereby consumers can have real time access to consumption data through their HAN-enabled smart meters once deployed, and day behind consumption data over the Internet in the interim.[52] Over time however, real time access to a user's energy usage data will become essential.

- **Consumer consent mechanisms should be simple, clear and electronic.** Consumers should have the right to control access to their personal consumption information and should have the right to consent to the disclosure of this information to third party smart grid providers. The consent mechanism by which consumers can direct utilities to provide information to third parties, however, should be simple, clear and electronic. Unnecessary logistical hurdles or complicated approval processes will harm consumers by reducing their ability to maximize the value of this information.
- **Consumers own their consumption data and they (and third party suppliers) should not be charged to access this data.** Consumers own the consumption data generated by the smart grid and have paid for the costs of such technology through regulated rates. Consumers should not be charged for obtaining access to this information or for providing it to a third party smart grid provider, as this could amount to a double charge on consumers.
- **Data access rules should specify a minimum amount of consumption data that utilities must collect and make available.** While unreasonable caps on the types of data accessible by consumers are inappropriate, they should consider placing floors on the types of consumption data utilities must make available to consumers. This floor should include at least interval data, historical usage, energy source, and retail and wholesale prices.
- **Data access rules should not place unreasonable limitations on the companies or devices that can access consumption data.** Provided that a company has received informed authorization from the consumer and demonstrates that it has implemented industry security and privacy policies, such company should not be prohibited from accessing the consumer's usage data and pricing information. For example, there should not be a cap on the number of approved HAN devices that a consumer can connect to their smart meter or access smart meter data. Instead, any provider that complies with industry-standard security and privacy practices and has received consent from the consumer to access consumption data should have the right to obtain this access. Additionally, the utility should not be required to police consumer consents to determine whether they are appropriate.
- **Data access and privacy policies should recognize consumers' right to privacy in their energy usage information and give consumers the ability to make informed decisions about utility and third party access to this data.** The DOE inquiry into smart grid privacy and data access highlighted the widespread support for the idea that consumers have a privacy right in their consumer energy usage and should have the right to control access to this data.[53] They should also have the right to make informed decisions about making this information available to third parties. Existing laws and privacy practices support these principles and strike an appropriate balance between privacy and access. Layering on additional smart grid-specific privacy rules could limit the national markets for smart grid technologies. Policymakers should be encouraged to utilize best-of –breed privacy practices and broad consensus building efforts in considering smart grid data access policies and privacy principles.

[52] See Order Instituting Rulemaking to Consider Smart Grid Technologies Pursuant to Federal Legislation and on the Commission's Own Motion to Actively Guide Policy in California's Development of a Smart Grid System, Decision Adopting Policies and Findings Pursuant to the Smart Grid Policies Established by the Energy Information and Security Act of 2007, Cal. Pub. Utils. Comm'n, Decision No. 09-12-046 , 3 (Dec. 17, 2009).

[53] DEPT. OF ENERGY, DATA ACCESS AND PRIVACY ISSUES RELATED TO SMART GRID TECHNOLOGIES 11-12 (Oct. 5, 2010).

CONCLUSION

The consumer domain of the smart grid holds substantial promise for achieving the nation's energy objectives. Without a restructuring of the consumer domain, however, these anticipated benefits may not be possible. In addition to the adoption of nationwide interoperability standards, there are two fundamental policy shifts that must be implemented. First, dynamic pricing programs must be implemented to provide consumers the economic incentive to curb or shift consumption and to create a market for efficiency enabling technologies. Second, policymakers must take steps to ensure that consumers have access to their consumption information so they can understand their usage and respond to pricing signals.

These shifts will unleash innovation within homes and businesses and revolutionize the way the nation generates, stores and consumes energy.