# Environmental Protection Agency Proposed Rule on Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units

Docket No. EPA-HQ-OAR-2013-0602 November 26, 2014

## Comments of the
## Association for Demand Response and Smart Grid (ADS)

## Introduction

The Association for Demand Response and Smart Grid (ADS), is a diverse organization of utilities, ISO/RTOs, technology companies and service providers[1] with a mission of developing and facilitating the exchange of information about smart grid technologies and practices such as demand response. With this submittal, we seek to provide comments and suggestions on the aspects of the EPA Clean Power Plan Proposed Rule that deal with state compliance plans.

We applaud the EPA for the flexibility that it has provided with respect to development of compliance plans. However, we believe the Proposed Rule does not go far enough in providing clarity and guidance to states and other parties on the extent of that flexibility and how to go about using it. In fact, we know from direct observation at various conferences and events that the Proposed Rule has caused confusion among state agencies and policymakers, utilities and other parties.

Our comments will provide support as to why EPA should address this concern in its Final Rule by offering more guidance and information to all parties on smart grid and demand response in the context of developing compliance plans.

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[1] ADS is a 501 c (3) non-profit organization. More information can be found at www.demandresponsesmartgrid.org.

## Confusion Created by the Proposed Rule

We believe the confusion begins with the construction and formatting of the Proposed Rule itself.

The Clean Power Plan appropriately devotes considerable attention to and explanation of how the state emissions reductions goals were developed. In doing so, it chooses to use the organizational structure of “building blocks”. The term “building block” has been widely and broadly interpreted by readers of the Proposed Rule to imply that the “blocks” are what a state would use to “build” its plan. In other words, there is a widely held interpretation that EPA is designating the four building blocks as the menu of eligible choices that a state has to work with in putting together its plan – not the building blocks that EPA used to develop the goals.

This misinterpretation is not based on loose anecdotal information. Multiple parties, including state utility commissioners, have stated as much at NARUC events and industry conferences.

Even though the Proposed Rule goes on to explain the flexibility that it provides for *compliance*, the structure and wording of the document leads to the interpretation that flexibility only applies within the four building blocks. Since demand response and smart grid do not appear in any of the blocks, not even the one on energy efficiency, a signal is being sent that those tools are not eligible to be used in state compliance plans, even if this was not EPA’s intention.

In Building Block 4, energy efficiency is defined solely as “end-use” efficiency. This is the traditional definition of energy efficiency (i.e. modify a device or piece of equipment to make it more efficient). But that is not the modern, evolving definition of energy efficiency. Today, several different types of efficiency are being deployed in the electricity sector. Demand response represents dynamic, dispatchable efficiency. Use of new informational technologies and practices has created behavioral efficiency and automated intelligent efficiency. Deployment of smart grid technologies and practices has created new options to increase the efficiency of the distribution system.

The definition used in Building Block 4 may be the appropriate one for its purposes in goal-setting. However the adverse impact on DR and smart grid created by the confusion over the building blocks as menus is being compounded by the Building Block 4 definition of energy efficiency.

States can include in their compliance plan anything that can be shown to help meet the emissions reductions goal. In the Final Rule, EPA must clearly express this flexibility. It should go further and list and explain emissions reductions options that are pertinent, but not necessarily the first to be thought of, such as demand response and smart grid.

## Terminology and Inclusive Definitions Should Be Used in the Final Rule

ADS considers smart grid to be a holistic, umbrella term that encompasses demand response, distributed energy resources, microgrids, electricity/energy storage, distribution automation, and other grid modernization and optimization strategies. ADS urges EPA to accept and convey a similar use of terminology in its Final Rule so that it is clear to states that they have the flexibility to include smart grid, as well as the options included under “smart grid”, in their compliance plans.

## Demand Response and Smart Grid Reduce Energy Use and Therefore Reduce Emissions

Demand response (DR) and smart grid are not yet widely thought of as emissions-reducing options for two main reasons:

1. The traditional view of end-use energy efficiency is strongly embedded in all corners of the electricity industry. Because such efficiency is “built-in” to a device, it is seen as that which can be forecasted, quantified, and depended upon, and it has been the bedrock of energy efficiency in the electricity sector to date.

2. DR and smart grid are usually considered to be focused only on peak demand, as measured in kW. They are not thought of as focused on, or yielding any reduction of, kWh.

The traditional view of energy efficiency – use less energy within an appliance or building to produce the same result – is extremely important and should be maintained as a “go-to” option within the efficiency family. Every electricity-using device should use energy as efficiently as possible. However, while the embedded efficiency of devices may be equal prior to their installation, how those devices are used – and therefore how much energy they use - can vastly differ based on many factors. Importantly, traditional efficiency now has “siblings”, and the efficiency family is growing in meaningful ways. The new types of efficiency (e.g., DR and smart grid) bring new technologies that precisely measure energy reductions and help to introduce better measurement and verification for traditional efficiency.

Peak reduction has long been a goal of utility, state, and (more recently) wholesale demand response programs, starting with the previous era of “load management” and continuing to the modern era of demand response and dynamic pricing. The value that peak reduction creates is enormous, as it allows negawatts to compete against megawatts, and for deployment of the dirtiest, least efficient and most costly power plants to be avoided during the peak period. Benefits of peak reduction include lower wholesale costs, mitigation of market power, and vast costs avoided by the contribution of DR to reliability and the avoidance of system disruptions.

What is not widely understood is that in addition to reducing peak demand (kW), demand response also saves kWh. Equally important, new technology-based options that fall under the definition of smart grid also can reduce kWh.

Various studies have documented the energy savings associated with demand response and smart grid technology. The savings occur in six types of programs, as follows:

- Demand response: kWh savings from increased awareness of energy usage associated with dynamic pricing programs

- Demand response: kWh savings from demand response events and reliability programs

- Intelligent efficiency: kWh savings associated with energy consumption feedback made possible by smart meters or resulting from more efficient operation of HVAC systems via smart thermostats

- Grid efficiency: kWh savings from conservation voltage control

- Grid efficiency: kWh savings from reduction in technical and non-technical line losses

- Grid efficiency: KWh savings from the modernization and more efficient operation of distribution systems.

Each of these is addressed below.

***Demand response, dynamic pricing.*** While a main purpose of dynamic pricing is to reduce peak demand, these programs typically result in a reduction in total electricity consumption as well. There are three reasons energy reductions can be expected from dynamic pricing. First, higher peak or critical peak prices induce load reductions during peak hours, some of which is shifted to other times, and some of which is not. Reducing lighting during peak periods does not lead to the use of more lighting during off-peak periods, for example. Higher thermostat settings during the peak period may be offset in part by precooling or payback cooling (increased cooling after the end of the peak period), but empirical evidence indicates that peak-period reductions are typically larger than the increased usage outside the peak period. Second, dynamic pricing programs cause participants to have a higher awareness of how they use energy, which may in turn result in lower consumption. Third, these programs often increase the amount of usage information, or feedback, received by the customer, which can also lead to reductions in energy use. Total consumption reductions from dynamic pricing programs have been measured from 0% to as high as 8.7%, with a typical number of perhaps 2%.[2]

***Demand response, reliability programs.*** Demand response resources in reliability programs are available during the top 100 peak hours of the year. They are dispatched by utilities or grid operators to avoid or meet system emergencies. These reliability programs typically include interruptible and curtailable programs for commercial customers and direct utility control of residential air conditioners. The available information, based on more than 25 evaluations of these types of programs since 2004, suggests a very slight conservation effect, because the amount of usage curtailed during events is more than the amount of usage incurred after events to "pay back" peak reductions.

***Intelligent Efficiency.*** "Intelligent efficiency" is a systems-based approach to efficiency. Enabled by information and communication technology (ICT) and user access to more detailed and sometimes real-time consumption information, intelligent efficiency differs from traditional energy efficiency in that it is adaptive, anticipatory, and networked. Opportunities exist along a continuum of technology and human behavior and include both people-centered efficiency and technology-centered efficiency (e.g. smart thermostats).[3]

The literature suggests that customers are most fully empowered to manage their consumption and maximize their benefits with a triad of approaches: 1) information to enhance understanding, 2) pricing options to provide financial incentives to avoid high-cost peak hours, and 3) automation to allow "set and forget" response. Each of these

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[2] - See, for example, Chris King and Dan Delurey, "Efficiency and Demand Response – Twins, Siblings, or Cousins?" Public Utilities Fortnightly, March 2005 and Jessica Stromback et al., "Empower Demand," October 2011.

[3] - ACEEE, "A Defining Framework for Intelligent Efficiency," Research Report E125, June 2012.

provides benefits individually as a program type, but can provide even more energy reductions when provided as a holistic menu of options.

The concept of people-centered efficiency is that customers reduce their energy consumption as a result of having better understanding of their consumption. This better understanding comes from access to more detailed information (e.g. hourly and daily consumption) on utility websites, or even real-time information from in-home displays connected directly to meters. Utility websites or energy reports to customers can also include comparisons to similar customers and specific energy savings tips.

One mechanism of information-based energy savings is behavior change – switching the lights off or adjusting thermostats. The second mechanism occurs over time, with customers using energy data to make purchases of new appliances or devices that are more energy efficient. Based on dozens of pilot and large-scale studies globally, utilities have found short-term consumption reductions averaging between 5% and 9% for - customers who report viewing energy usage information.[4] These savings have been found to persist. Over time, more customers become engaged with their information, and total average savings increase.

Regarding technology-centered intelligent efficiency, one important example is smart thermostats that can be remotely controlled over the Internet. Service providers monitor the operation of these systems and, through analytics algorithms, control the thermostats so that HVAC systems use less energy. In addition to such algorithms, smart thermostats may be controlled by occupancy sensors, operating HVAC systems only when homes are occupied. These capabilities have been shown in pilot programs to reduce HVAC consumption by 6.8% to 11.3%.[5] Residential HVAC consumption in 2009 was 47.7%[6]. Another important example of technology-centered intelligent

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[4] - Jessica Stromback et al., Op. cit.

[5] - See Jiakang Lu et al., "The Smart Thermostat: Using Occupancy Sensors to Save Energy in Homes," Proceedings of the 8th ACM Conference on Embedded Networked Sensor Systems, 2010 and Nest Labs, Inc., "Energy Savings from Nest," White Paper, February 2014.

[6] - Energy Information Administration, "Residential Energy Consumption Survey," 2009, accessed at http://www.eia.gov/consumption/residential/ on November 10, 2014.

efficiency is a building energy management system. Research studies performed over the past decade have shown a range of energy savings for such systems—from none at all to annual savings of more than 30 percent. Average energy savings from these systems have been estimated at between 5 and 15 percent of overall building energy consumption.[7]

Given that homes and buildings together consume 40% of total U.S. energy[8], the reduction in consumption from smart thermostats and building energy management systems could yield total electricity savings of 2-4%.

***Grid Efficiency, Conservation Voltage Reduction***. Conservation Voltage Regulation (CVR) or Voltage Optimization improves the efficiency of the grid by optimizing voltage on feeder lines that run from substations to homes and businesses.

CVR is made possible by the addition of smart meters and other smart grid technology. In the US, regulations require that voltage is available to consumers at 120V +/- 5%, which yields a range of 126V to 114V. On any feeder line, voltage on the line gradually decreases as the cumulative load (number of customers) and distance on the line increases. Because of this line drop, power must be transmitted at a high enough voltage that the last house on the end of the line gets at least 114V. Without smart meters, utilities have had to use statistical models to estimate the end-of-line voltage. In order to ensure regulatory compliance, utilities have built in a small reserve margin, setting the substation voltage higher. Now, by knowing actual voltage at the end of the line, utilities can lower the substation voltage. This, in turn, lowers consumption, because the consumption at lower voltage requires fewer kWh.

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[7] - M.R. Brambley, et al., "Advanced Sensors and Controls for Building Applications: Market Assessment and Potential R&D Pathways," prepared for the U.S. Department of Energy by Pacific Northwest National Laboratory, April 2005.

[8] - Energy Information Administration, "How much energy is consumed in residential and commercial buildings in the United States?" 2013, accessed at http://www.eia.gov/tools/faqs/faq.cfm?id=86&t=1 on November 10, 2014.

Numerous CVR pilots have been conducted, and a few utilities are now deploying CVR technology on a system-wide basis. Based on the pilots and other programs, the national potential for energy savings from CVR has been estimated at 3%.[9]

***Grid Efficiency, Reduction in losses.*** Between the injection of electricity from large power plants and deliveries to customers, about 7% of electricity is typically lost. Transmission losses during hot, peak periods can be much higher. Most of these losses occur via transformer losses and resistance in lines that would not be cost effective to reduce. However, other losses can be addressed cost-effectively through the application of smart grid technology. Technical losses that occur due to minor equipment problems, unbalanced loads across feeders, and other technical issues can be corrected with more detailed smart meter and network information.

Technical and non-technical losses can be reduced by an estimated 5-10% to increase grid efficiency.[10] At the higher end, this translates into total electricity savings of about 0.5% - though the opportunity may ultimately be up to 1-1.5%.

***Efficiency of the Distribution System.*** The role of smart, transactive distribution grids in enabling energy efficiency in the grid itself, plus better integration of distributed resources such as microgrids is quickly gaining prominence and promises to introduce entirely new types of efficiencies into the electricity system. Major state regulatory efforts are underway in New York State and California to pursue increasing the efficiency of the distribution systems, and more information on such will be available over the coming year.

## Additional Information In Support of Inclusion of DR and Smart Grid

There are other reasons that demand response and smart grid deserve consideration for their emissions-reducing characteristics, which are noted below:

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[9] - KP Schneider et al., "Evaluation of Conservation Voltage Reduction (CVR) on a National Level," Report prepared for the U.S. Department of Energy, PNNL-19596, October 2010.

[10] - EPRI, "Distribution System Losses Evaluation," Report 1016097, December 2008.

1. DR will often reduce kWh consumption during the hours in which the plants with the greatest emissions are used to generate electricity. Thus, the emissions reduction achieved from reducing a particular number of kWh will typically be higher for demand response than for the same number of kWh avoided during non-peak hours. This means that a higher value could be placed on kWh that are reduced during the peak period.

2. While the Clean Power Plan is focused on carbon emissions, and not localized impacts, DR and smart grid offer dynamic emissions control that can ensure that steps that are taken based on a goal of reducing CO2 emissions also avoid adverse local and community-based impacts.

## Summary

It is important that EPA, long a leader on traditional energy efficiency through Energy Star and other programs, become a leader on creating an expanded and newly appropriate view and understanding of energy efficiency. It can start that leadership in its Clean Power Plan. EPA should clearly and directly expand the discussion of energy efficiency in its Final Rule to include demand response and smart grid, and should provide clear direction and guidance to states that they can consider such options for inclusion in their compliance plans.