

Energy Efficiency in 2020 –What do the experts think?

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Efficiency pessimists contend that there is little potential for further improvements in energy efficiency, since all the low-hanging fruit has been harvested. Ergo, the solution to meeting the nation's future energy needs in a carbon-constrained future is to build more power plants (preferably those that don't burn coal), transmission lines and distribution systems.

Efficiency optimists, on the other hand, contend that energy efficiency is essentially an inexhaustible well and we have a long ways to go before the bottom is reached. Their viewpoint suggests that enhancements in energy efficiency may eliminate the need to make investments in the power supply system, except for routine maintenance and upgrades.

And finally, efficiency realists contend that the truth is somewhere in between.

The question of how much energy efficiency is available continues to come up, since we in the United States have been encouraging energy efficiency in one form or another ever since the first oil shock of 1973. The first wave of programs involved moral exhortations (as in the famous call to put on a sweater by President Jimmy Carter), information dissemination and energy audits. The actors were government agencies and community organizations and the slogan was "energy conservation." Federal legislation was passed in 1978 to give an impetus to conservation. National efforts at cutting back use were redoubled when the second oil shock hit in 1979.

The second wave was led by the utilities and gifted the somewhat clunky term demand-side management (DSM) to future generations. The focus of DSM was on improving energy efficiency and not on asking consumers to make do with less, *i.e.*, energy conservation. Conservation was frowned upon because it meant that consumers would have to change their behavior, which might be perceived as an unwelcome intrusion into their lives and even considered un-American by some. Incentives in the form of rebates and low-interest financing were used to encourage consumers to buy more efficient equipment and buildings. Utility spending on DSM programs peaked in 1993 as the industry prepared for restructuring, which arrived in the mid-to-late 1990s.

The energy crisis that plagued California's energy markets in the years 2000 and 2001 set in motion a third wave of programs that revolved around the concept of Demand Response. Customers would be provided incentives either through dynamic pricing or cash payments to curtail their usage during times when the power system was stressed, either because of a shortage

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of capacity or because of a peak in demand caused by extremely hot weather. Some of these programs could be instituted with existing meters while others required the deployment of smart meters. As of this writing, some 22 smart meters have been deployed in the US and there is an evolving consensus that the number will rise three-fold in the next five years. Demand response programs represented a major change in the industry's conception of customers as a resource.

Changing consumer behavior, along with behavioral economics, is in now in vogue and appealing to an increasingly widening circle of folks who are active in the energy domain. A fourth wave of programs, sometimes called integrated DSM (iDSM), is upon us.

This new wave of iDSM programs include those that inform consumers about how their energy spending compares with a group of peers and helps them to establish targets for optimizing use. These types of consumer-focused programs are finding widespread acceptance, saving one or two percent of energy consumption simply by inducing consumers to change behavior. Consumer-focused programs may save even more by enhancing consumers' awareness about where their energy dollar goes and by directing consumers toward rebates and low-interest financing that may be available from utility DSM programs.

As a result of iDSM programs, Energy Star labels on appliances are almost ubiquitous in "big box" stores, steering consumers toward efficient purchases. Zero-energy homes are being constructed that produce enough energy through renewable sources to meet their own needs.

Aggressive codes and standards are making an impact on the appliance manufacturing and building construction industries, especially in states such as California which have their own supplemental codes and standards that push the envelope beyond federal requirements.

Nowhere is this transformation in consumer buying habits more visible than in the imminent phase out of incandescent bulbs, called upon by the Energy Independence and Security Act of 2007. Compact fluorescent lamps are expected to get a substantial boost from this legislation, but light-emitting diode (LED) lamps may lead to even greater savings. The current issue of Wired magazine features them on the cover.² They are expensive but prices are expected to come down as scale grows.

And this fourth wave, iDSM, is not confined to the residential sector. It is not uncommon to see full page ads in the mainstream media by companies such as Johnson Controls and Schneider Electric touting projects in which they helped large commercial and industrial facilities reduce their energy bill by 30 percent.

Finally, it is important to note that electric rates are now being redesigned to incentivize efficient energy use, with inclining block rates and time-varying rates being two concepts that are receiving increasing interest by utilities and policy makers. So the third wave, more

² http://www.wired.com/magazine/2011/08/ff_lightbulbs/

comprehensive than the first two, is built around five policy instruments: (a) information (b) codes and standards (c) technological change (d) rebates and low interest financing and (e) rate design.

The EE2020 Survey

The European Union has set a target of 20 percent savings in energy consumption by 2020.³ In the same time frame, how much energy will be saved in the United States through the pursuit of energy efficiency?

The Brattle Group, in conjunction with Global Energy Partners (GEP), posed this question to some of the nation's leading energy experts. Specifically, we asked them to tell us what they expected would happen during the next decade; not what could happen or what is technically feasible, which is often how the question is posed.

Fifty of the polled experts responded to the survey. They are spread out across the U.S. and represent a variety of institutions including universities, governments, utilities, research laboratories and consulting firms. The detailed findings of the study, called *The EE2020 Survey*, will be released next month in a *Brattle-GEP* whitepaper. The highlights are summarized below.

Overall, the experts expect that national electric consumption will decline by between 5 and 15 percent by the year 2020, compared to what it would have been without incremental improvements in energy efficiency. The range of savings in national natural gas consumption due to energy efficiency improvements is between 5 and 10 percent. Demand response programs are expected to lower the national peak demand for electricity by 7.5 to 15 percent.

There is considerable regional variation (the regions are the same as U.S. census) in the results. For example, the West North Central Division is expected to only see savings in electricity consumption in the 1.5 to 2.5 percent range while the Mountain Division is expected to see savings in the 5 to 16 percent range. On the natural gas front, the lowest savings of under one percent are expected from the West South Central Division. Much higher numbers of up to 12 percent are expected in the New England, Middle Atlantic, and East North Central Divisions.

There is also variation across the sectors. For example, the residential sector is expected to see electric savings in the 10 to 12 percent range. It is expected that 40 percent of consumers will buy high efficiency air conditioners and 60 percent will buy high efficiency lighting systems. Some 50 percent of commercial and industrial consumers will buy high efficiency HVAC systems and approximately 70 percent of large commercial and industrial consumers will buy high efficiency electric motors.

In the demand response sphere, direct load control programs are expected to reach 10 to 15 percent of residential consumers. But dynamic pricing programs, which currently reach less than

³ http://ec.europa.eu/energy/efficiency/action_plan/action_plan_en.htm

one percent of residential consumers, are expected to garner between 7.5 to 20 percent of residential consumers in the U.S. as a whole and the range could be as high as 12.5 to 45 percent in the East North Central Division. Participation rates for commercial and industrial consumers in dynamic pricing programs will be higher than in residential markets, as one would expect, ranging from 10 to 30 percent.

In summary

The EE2020 survey reveals a surprising consensus on the size of the energy efficiency resource, even though there is considerable variation across regions, sectors, programs and end-uses. Overall, energy efficiency is expected to lower electricity consumption by 5 to 15 percent, peak demand by 7.5 to 15 percent and natural gas consumption by 5 to 10 percent. These reductions are being driven by a number of factors including (a) long-standing policy drivers such as rising fuel and capital costs, (b) rapid advances in appliance and building technology, brought on partly by government mandates and partly by competitive economics, and (c) cultural shifts in American values which encourage behavioral change. The survey results clearly repudiate the notion that the age of energy efficiency has come to an end. On the contrary, they herald a new beginning for energy efficiency.