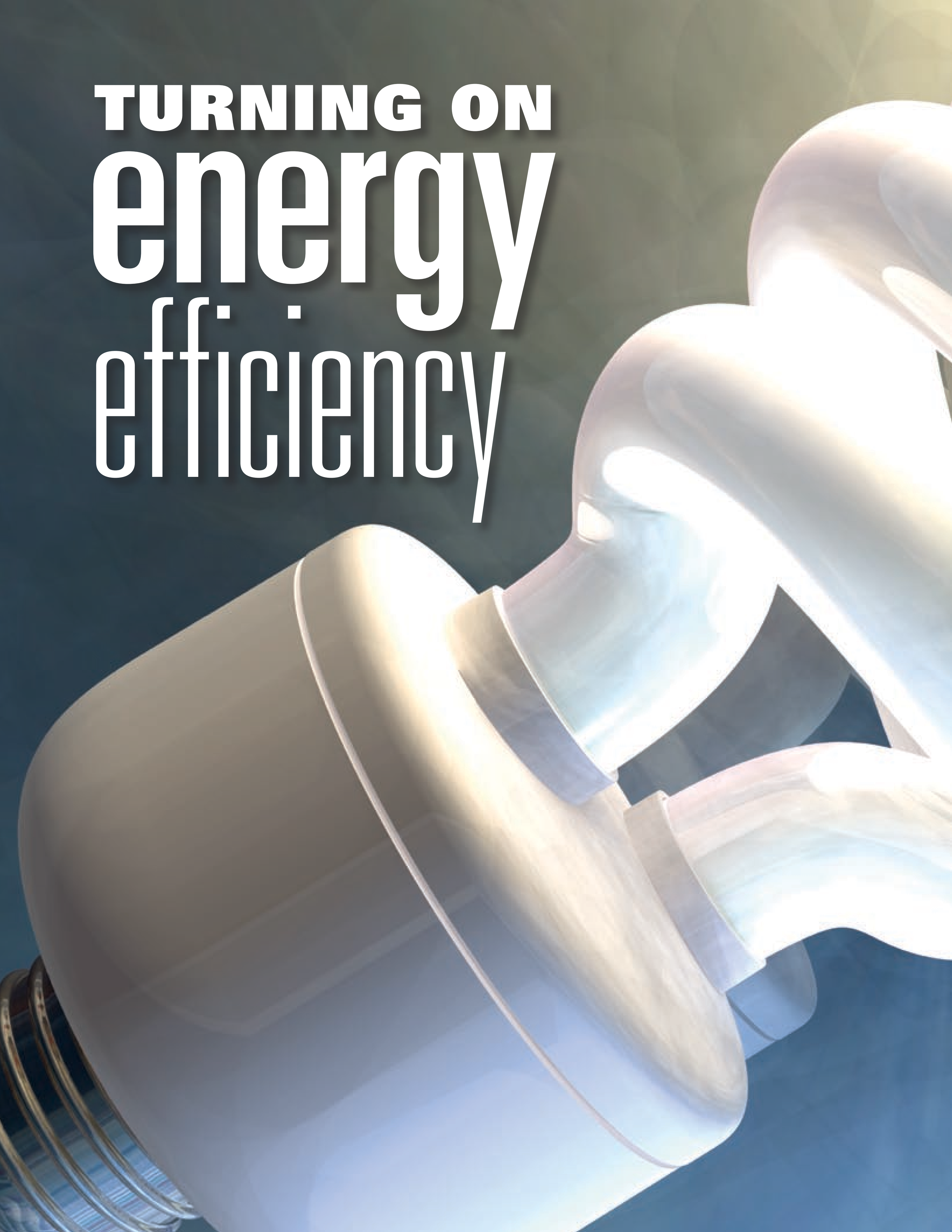
TURNING ON energy efficiency



The Story in Brief

Today, in the face of rising fuel costs and increasing concerns about carbon emissions, electric utilities and policymakers alike are taking a new look at energy efficiency as a least-cost solution. And with the development of advanced sensors and communications technology, an era of interactive, two-way learning is emerging that can augment and reinforce traditional forms of energy efficiency. Four building blocks lie at the heart of future progress—advances in communications, smart end-use devices, regulation, and markets.

Imagine walking into an empty room that can adapt to your presence. It has learned your preferences for lighting, temperature, ventilation, and humidity, and it starts reconditioning the space for you in the context of the energy efficiency guidelines for the building, the ambient weather conditions outside, and the marketplace for electricity. Walls and windows are embedded with microscopic sensors, and every individual device and appliance in the room has an embedded microchip with an Internet Protocol (IP) address that receives direct pricing signals from the local electricity provider. Prices move up and the fan slows down or the air conditioning takes a pause. The sun breaks through the clouds and the window glass tints. The room seems a bit stuffy, you simply say so and it responds with a little more fresh air. This type of networked intelligence is all part of the coming "third wave" of end-use energy management that EPRI labels *dynamic systems.* It rests on the emergence of a smart energy controls infrastructure that should be here, at least in cutting-edge commercial design, before 2015. In principle and in terms of the technical potential, it is already here.

The first wave, *energy efficiency,* includes evolutionary efficiency improvements that result naturally from economic factors in free markets. As computers have become smaller and faster, for example, their energy requirements have gone down. This kind of efficiency improvement is pervasive throughout the economy and is part of the relentless drive by organizations, industry, and businesses of all types to improve productivity, to accomplish more with less. The efficiency advantage is physically built into the evolving end-use equipment or process itself, requiring no special action on the part of the user to save energy. Knowledgeable professionals in the field believe that such evolutionary improvements will continue to reduce the growth in electricity demand in the United States by as much as 1% a year.

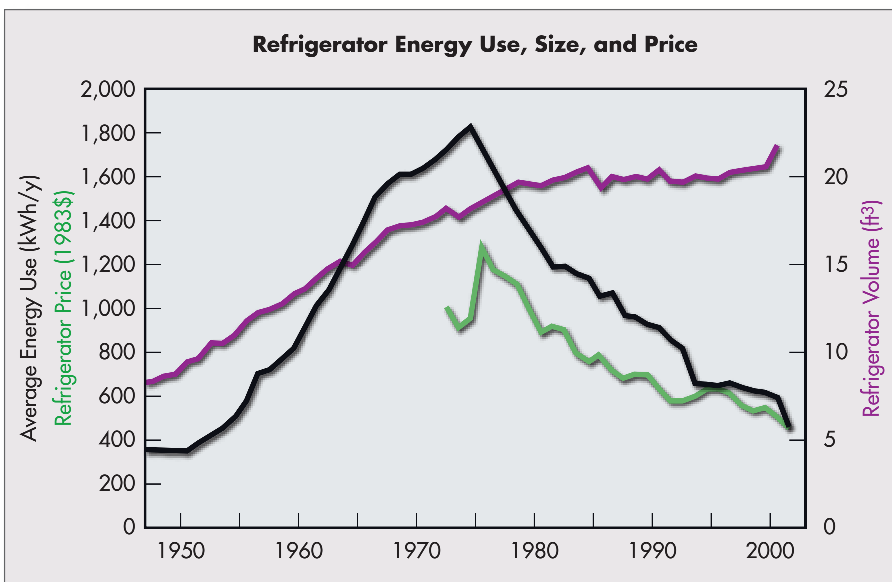
Built-in efficiency gains were given a strong governmental boost during the energy crises of the 1970s, when energy efficiency became a focal point of policy and regulation. Appliance standards, building codes, and utility demand-side management programs introduced a wave of prescriptive measures to augment and accelerate evolutionary improvements. Standards were set and programs were launched, some—such as EPA's ENERGY STAR® program—having large and lasting impact. One of the most dramatic success stories is the refrigerator. As a direct result of federal efficiency standards, refrigerators today use only one-third the electricity consumed by their predecessors of the 1970s, even though unit size continues to increase. Interestingly, the unit price has declined as sharply as energy consumption.

The legacy of these diverse efforts has been to encourage the adoption of more-efficient appliances, the progressive tightening of building codes, and the evolution of HVAC (heating, ventilating, and air conditioning) designs and energy management systems. According to recent studies, the potential energy savings from energy efficiency programs could amount to 5–10% of total U.S. electricity consumption. These savings would be in addition to the evolutionary improvements.

The combined advantage of evolutionary and programmatic changes—ranging from the use of more insulation to the development of better compressors—provides a permanent reduction in energy demand. This benefits customers and society by reducing emissions as well as by reducing or deferring the need for new generation and transmission and distribution (T&D) investments.

The second wave, *demand response,* also began in the 1970s. In this case, the efficiency savings are not built into the end-use appliance or facility but rather are a response function—generally under the control of the customer—that alters the pattern of energy use. Typically, the purpose is to shift demand away from the daily or seasonal peaks, providing some relief to utilities when supplies are tight and costs are high. According to a variety of studies, the potential savings are in the range of 10–20% of peak load.

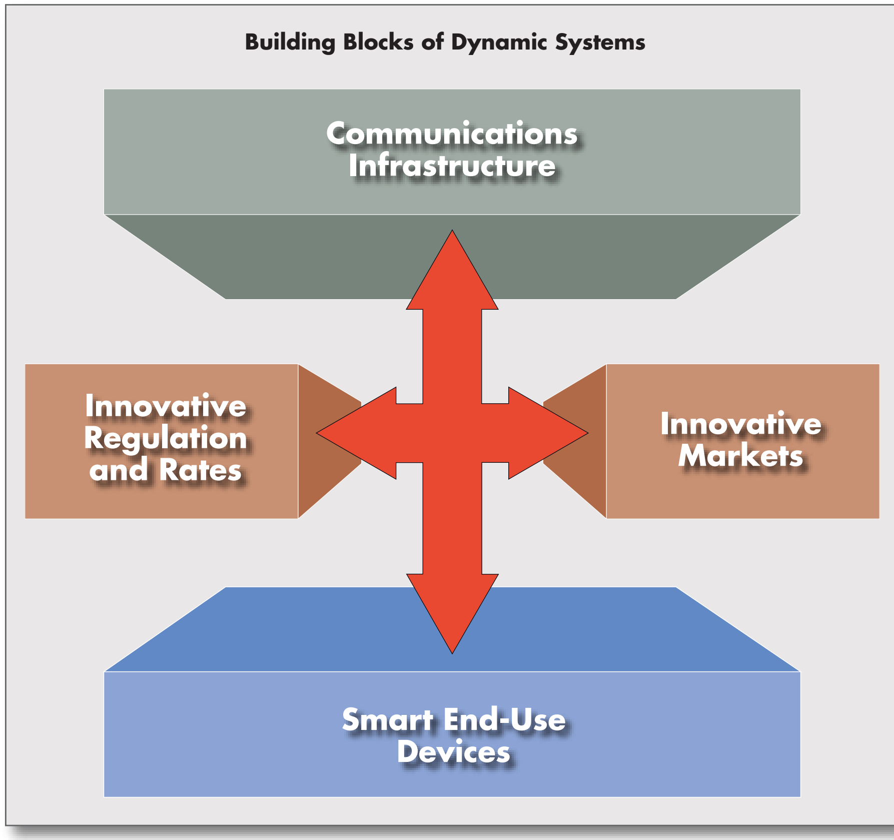
Demand response programs have mostly involved industrial and large commercial customers, whose buildings are controlled



Electricity consumption by refrigerators grew in lockstep with increasing size until energy efficiency standards were instituted in the 1970s. While size has continued to increase, today's refrigerators use less than one-third the energy of their 1970s predecessors, and refrigerator prices have also fallen. (Source: Lawrence Berkeley Laboratories) by sophisticated energy management systems that can work with pricing signals from the local service provider. In certain load reduction programs, the industrial or commercial customer may respond to a notification (by phone, e-mail, or fax) from the utility to reduce load. Programs for residential customers have generally been limited to time-of-day rates, which encourage the shifting of loads to off-peak times, or control by radio or power line carrier signal to curtail or cycle larger loads such as air conditioning compressors.

The third wave, *dynamic systems,* exemplified by the adaptive room scenario, adds intelligence and automated response to the processes and end-use equipment, allowing increased functionality without a rise in electricity demand. Dynamic systems use some of the tools developed for conventional demand response programs, along with advances in communications and emerging smart end-use technologies. This third wave again frees the end user from the need to take action; after the system is set up and general preferences are specified, the appliances themselves make the decisions and even "learn" how to best accomplish efficiency and comfort objectives.

The opportunities of these three waves working together could be substantial, not only to reduce electricity demand and usage, but to address the great societal concerns of the future, such as climate change. According to Steven Specker, EPRI's president and chief executive officer, "The convergence of advanced technologies and communications—including next-generation meters, intelligent end-use devices, and advanced communications infrastructures—offers tremendous opportunities to promote innovative regulation, rates, and markets and to turn load management to the problem of reducing CO_2 emissions." The climate change issue has become one of the key driving forces in the industry today and has brought a new sense of urgency to energy efficiency. Many see energy efficiency as pivotal to reaching global CO_2 emissions targets (see sidebar, "Reducing CO_2 Emissions," on page 9).



Four building blocks are needed to create the smart energy control system that can unleash the next wave of efficiency potential. Innovative rates and regulation will allow pricing structures that encourage efficiency "products" to be incorporated into new market offerings. Smart end-use devices will receive pricing signals directly from power suppliers through an integrated communications infrastructure and will make their own operational decisions on the basis of preset cost, efficiency, and comfort variables.

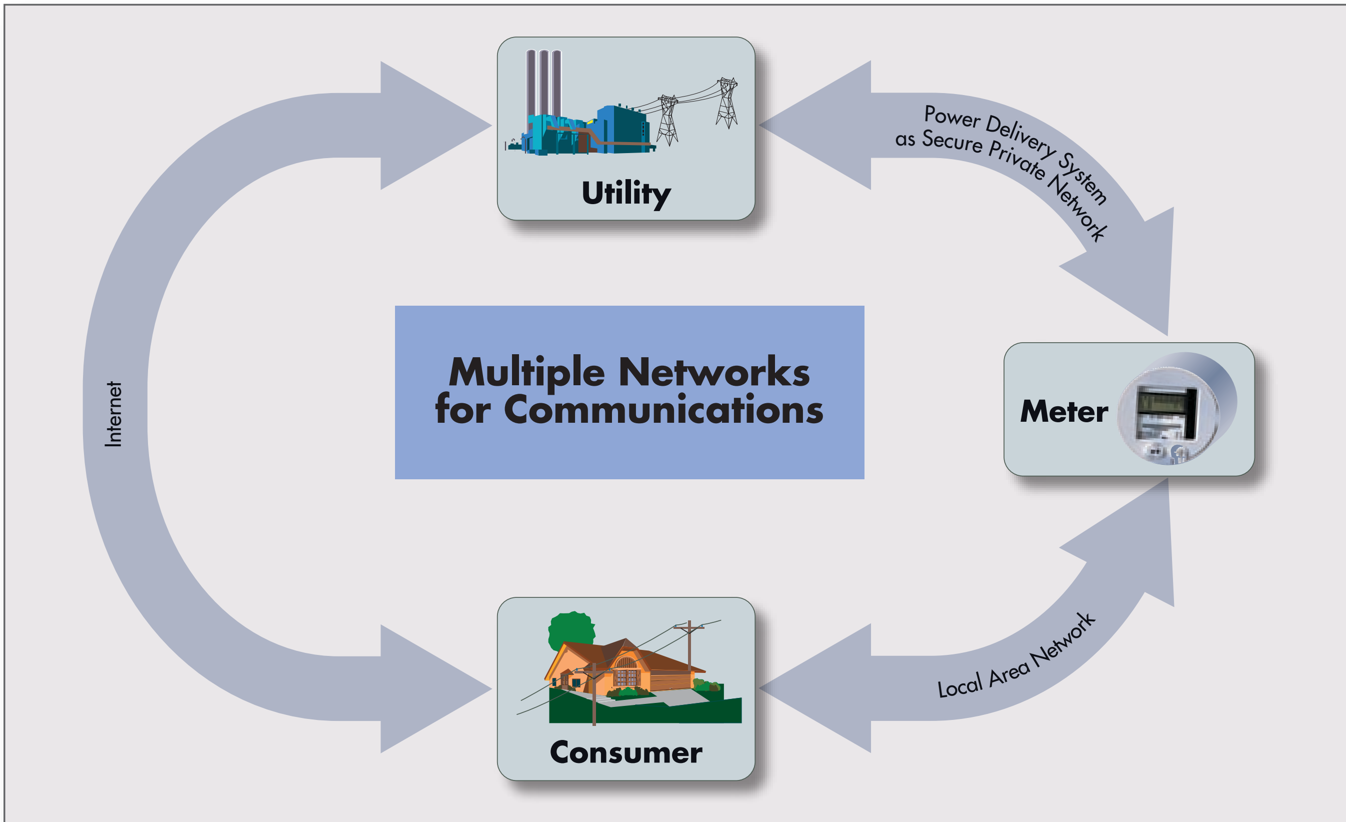
Four Building Blocks

EPRI sees four building blocks necessary to create and support the smart energy controls infrastructure of the future: a communications infrastructure, smart end-use devices and processes, innovative rates and regulation, and innovative markets.

Communications

An advanced communications network will add new functionality to the electricity system that will allow electricity providers to exploit the new technical capabilities in society, ranging from smart appliances in the home to high-tech industrial processes. To tap these capabilities, market information would be exchanged directly with smart end-use devices. This prices-to-devices℠ approach would allow the appliance or equipment to manage its own operation to meet predetermined cost or performance targets. Such a network could also enable devices within a home or business to interact with each other to increase overall consumer benefit.

One linchpin technology in this concept will be the meter. Intelligent meters, working with standardized communications protocols and consumer equipment such as televisions or home computers, can create a two-way information portal through which customers and service providers will interact directly. According to Joseph Hughes, project manager in EPRI's Power Delivery Science and Technology Development Division, "Intelligent meters offer utilities real-time data and applications to serve a wide range of business



Multiple two-way networks can be used for communications between customers and utilities, depending upon the specific need. Standardized wide-area communications links—such as the Internet—are best used for basic information exchange, where privacy and security are not important. Control functions and connections to the power grid will require secure networks.

operations, including transmission, bulk power management, and distributed energy resource integration. They provide intelligence for outage crew dispatch, voltage and reactive power management, power quality monitoring, and advanced asset management functions. They support real-time pricing, billing, change of service, and outage communications. And they enable utilities to offer innovative services such as consumer equipment management, diagnostics, and repair."

A number of U.S. utilities have conducted trials of limited numbers of smart meters and associated communications, but the lack of investment return is a notable stumbling block. With the average profit from a residential customer amounting to around $35/year, it is difficult for any investor-owned utility to justify the installation of a $300 smart meter unless it can be used to facilitate multiple revenue-generating or cost-saving applications. In Europe, ENEL has accomplished one of the most ambitious and significant deployments of such communications-enabled meters in Italy, where over 27 million meters have been installed. Currently, the primary functions used are transmission of consumption data back to the utility and automatic reading of time-of-use rates by the meter. Similarly, Electricité de France is considering installation of 34 million new meters. Other European utilities have installed several hundred thousand of the advanced devices.

Communications protocols for utility-customer links are typically incorporated in signals transmitted through the power line, or wirelessly to an Internet access point (similar to a wireless computer network in a home). Open standards–based communications connectivity is expected to eventually enable the integration of intelligent end-use equipment. A number of options are under consideration for providing new levels of communication between utilities, customers, and intelligent energy systems and appliances. The Internet is a possibility, but at present, it can deal only with information, not with controls. Other options include an advanced Internet with secure protocols, broadband over power lines (BPL), cable, fiber optics, and wireless. In addition, an open standards–based common language will one day enable equipment to "talk," ushering in a level of equipment integration not possible today.

According to Specker, a key to success will be creation of the anticipated open standards–based communications system that will allow all vendors to participate: "The physical communications network can embrace a variety of options. As a strategy, we need to stay flexible and keep the door open for all types of communications that offer appropriate levels of security and protection. Right now the system is still evolving." EPRI is supporting both the vision and the development of the open standards needed to integrate equipment across the industry.

Smart End-Use Devices and Processes

Through advances in distributed intelligence, end-use technologies are beginning to evolve from static devices to devices with a much greater dynamic range. Many appliances that are being manufactured today contain microchips that have IP addresses, meaning they are potentially accessible through the Internet or some other network and can therefore interact directly with suppliers.

One example of equipment that is being upgraded for dynamic performance is the ubiquitous fluorescent light. Southern California Edison has proposed a pilot program that will use utility-controlled, dimmable, energy-efficient T-5 fluorescent lighting as a retrofit for existing T-12 lamps in commercial, educational, and industrial facilities. SCE will be able to dispatch these lighting systems using wireless technology and hopes to reduce lighting load at those facilities by as much as 50%.

The efficiency of a residential air conditioning system or a commercial HVAC system could also be made more dynamic. Embedded software and hardware in the system could optimize operation to minimize consumer energy costs through the use of Internet-accessed hourly electricity prices and day-ahead weather forecasts, coupled with learned patterns of building cool-down and heat-up rates, occupant habits, outside temperatures, and seasonal variables. In practice, these capabilities might play out in the following way: The air conditioning system in a building reads tomorrow's weather forecast—a hot day is coming, and electricity prices are going to be high during the hottest part of the day. The customer has already set acceptable temperature ranges or perhaps a cost limit to drive the air conditioner. The air conditioner has already learned, through neural networks, that it can make the house comfortable at a reasonable cost in such a situation by precooling in the morning when prices are low and reducing load during the peak period when prices are high. And it does so automatically.

Other innovative approaches could further promote the energy efficiency of appliances. The sale of electricity could actually be bundled with specially designed consumer devices—a new refrigerator, for example, could be sold with five years of electricity included in the purchase price. Because the device is designed to meet specific energy efficiency goals and has the capability to self-monitor and -meter, it has the means to optimize performance at a specified level of energy consumption. Of course, setting up such an offering would require regulatory flexibility and markets that permit the recovery of investments in efficiency and demand response.

Reducing CO_2 Emissions—The Driving Force Behind Efficiency

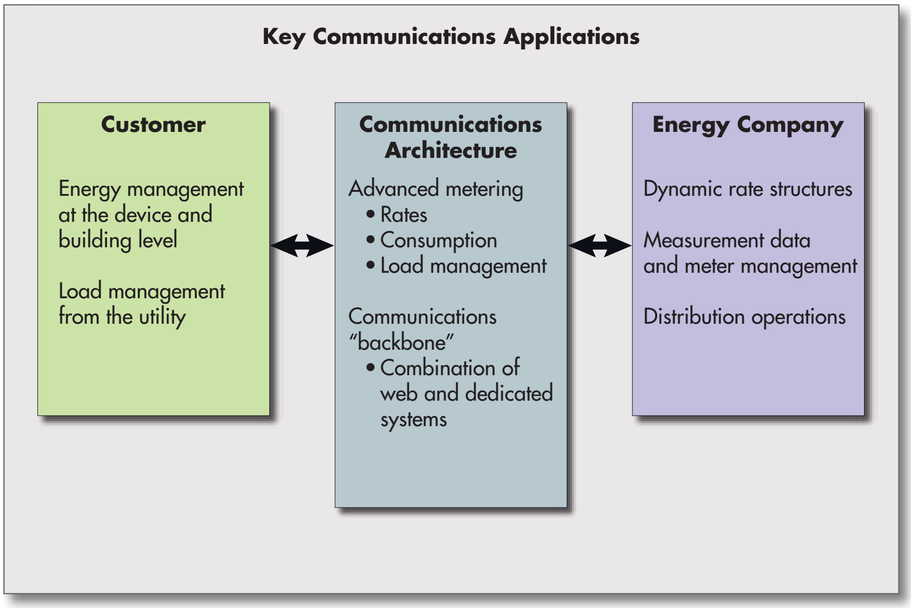
The 800-pound gorilla now driving long-term global energy policy—and by extension the long-term expansion planning of electricity suppliers—is climate change. Expectations are growing for the so-called efficiency option to assume a leading role in addressing CO_2 reduction, a role equal in scale to that of the major electricity supply options.

Efficiency policy goals will likely put a double burden on the electricity industry, since all large-scale efforts to move the nation toward cleaner energy will mean shifting more of the CO_2 burden to electricity producers. The reason is that electricity is the only practical means to deliver clean energy on a large scale—regardless of whether it is derived from nuclear, renewable, or fossil sources. The shift in the clean-up burden could accelerate sharply if the transportation sector moves headlong toward electricity in the next three decades through the introduction of plug-in hybrids and comparable vehicles.

The scale of the task is enormous. If climate policy is to achieve the current internationally agreed-upon goal of stabilization of concentrations of greenhouse gases in the atmosphere, a near-complete transformation of the energy system will ultimately be required—from a global energy system that is 85% CO_2-emitting today to one that is predominantly non-emitting. This will not be possible without substantial contributions through energy efficiency.

Climate policy could change the comparative economics of supply-side and demand-side options in the years ahead. Since climate policy will likely increase the cost of energy, the economic attractiveness of individual end-use energy efficiency investments will grow. Natural gas–fired generation sets the price of electricity in many regions. An $11/metric ton value assigned to CO_2 emissions could increase the cost of natural gas peaking equipment by $5–$7/MWh, likely creating substantial pressure to increase wholesale and retail electricity prices and to reevaluate efficiency options.

From a utility perspective, energy efficiency may be the low-hanging fruit in the search for ways to reduce carbon emissions. "It's going to be a lot less expensive than either renewables or the capture and sequestration of carbon," states Richard Hayslip, assistant general manager at Salt River Project. "We ought to take advantage of our opportunities for energy efficiency before moving on to the more expensive strategies."



Effective, dynamic efficiency management will require seamless information exchange between customers and their energy company. The communications architecture bridging these entities will require advanced metering to transmit rates and price signals, consumption patterns, and load management decisions.

The concept of automated interactive communication and control is extremely powerful, and many believe that networked intelligence will eventually come to dominate daily life. Cisco CEO John Chambers has a grand vision of the home in the twenty-first century that is based on a highly networked "digital lifestyle." Major hardware and software suppliers such as Intel and Microsoft now envision that every consumer device that can be networked will be networked. Consumers will use these interconnected appliances in the home for entertainment, convenience, health care, and energy management. Building control systems will use networked appliances for lighting, comfort, and energy management.

Standards are already under development to make sure that products will be able to network effectively in the future. The open architectures that enable interoperability now appear to enjoy wide acceptance, although it has taken years to achieve. Virginia Williams, director of engineering and standards for the Consumer Electronics Association, says it was market pull that forced the change: "Our own members…want a proprietary network. But people don't buy networks; they buy components, and they expect to be able to mix and match them, and they want competition on any given product. So the idea of a single-brand network…set back the industry maybe a decade."

With the home and commercial network in place to meet consumer demands for entertainment, comfort, and energy management, the capability to receive electricity price signals and manage device operations in response will be just another added functionality. Consumers will be able to select their energy management scheme and allow it to operate automatically—for example, to meet a desired comfort level at the minimum cost. Eventually, all electronic devices will have these capabilities, and the energy efficiency advantages will be inherent in the devices and the networks.

Innovative Rates and Regulation

Innovative ratemaking will be critical for ensuring a re-emergence of efficiency incentives. In the days before utility restructuring, state regulatory agencies set the prices that utilities could charge to make a reasonable profit. Such pricing structures folded energy efficiency into the mix as a societal good. Today, however, unless regulators create new incentives, efficiency has to stand on its own economic merits.

In all states except California and Hawaii, utilities are now, in effect, rewarded for selling energy and penalized for reducing customer sales. According to Diane Munns, a member of the Iowa Utilities Board and president of the National Association of Regulatory Utility Commissioners (NARUC), "Profits must be decoupled from energy sales. We need to provide incentives to utilities to lower customer energy use so that energy efficiency can be measured as part of a profitable business."

For investor-owned utilities, shareholders are also part of the equation. "One of the first steps needed is to show utilities that there is a balance between the needs of their customers and those of their shareholders," states Kristine Krause, vice president of WE Environmental. "To paraphrase an old NARUC resolution," says Michael Dworkin, professor of law and director of the Institute for Energy and the Environment at Vermont Law School, "a utility's least-cost strategy for its customers should also be the most profitable strategy for its investors."

There are as many ways to value energy efficiency as there are utilities. "Utilities that do not own generation should be valuing efficiency as an alternative to a power purchase for a term equal to the life expectancy of the efficiency investment," says Dworkin. "And utilities that do own generation should make similar calculations; however, they should focus on the comparative capital costs of efficiency versus generation and transmission."

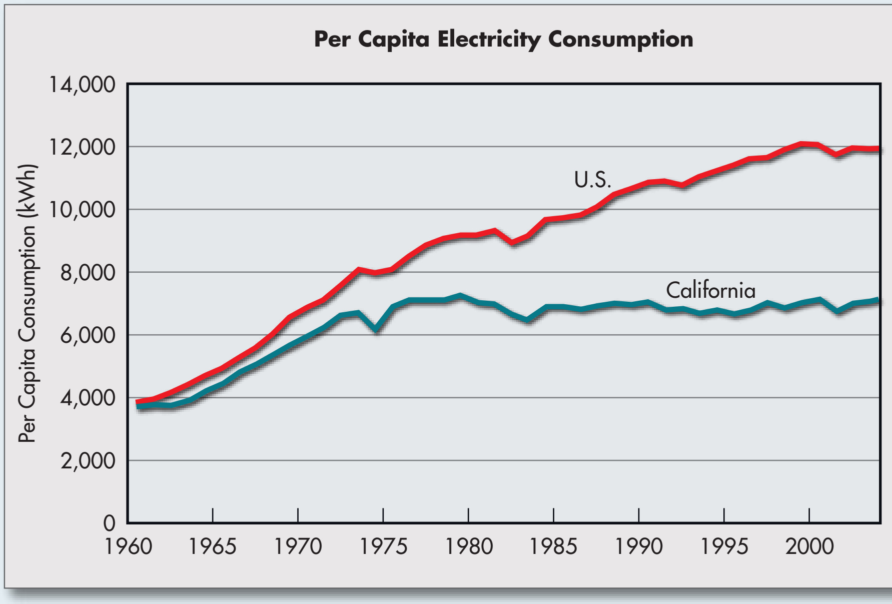
Any approach to incorporating the value of efficiency into rates must consider how generation itself is dispatched. Power providers turn first to the lowest-cost source of power: their baseload plants. As needed, they turn to medium-cost sources, and finally, to high-cost peak power units. Reducing energy use during peak periods

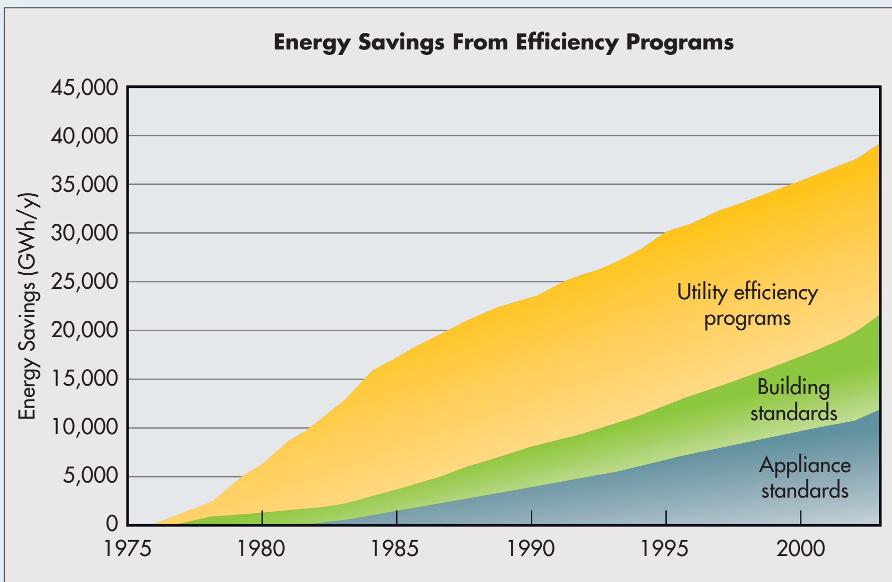
The California Experience

California is a prime example of what can be accomplished through sustained efforts in energy efficiency. The state's investments over the past 30 years in energy efficiency programs and improvements in building and appliance standards have held per capita electricity consumption constant at the 1975 level, while per capita use in the rest of the United States increased by nearly 50% (see graph). As a result, California saves about 40,000 GWh of electricity each year, roughly equivalent to 15% of the state's annual consumption. California's efforts have also reduced the state's peak demand requirements by 22%, allowing it to defer construction of 12,000 MW of peaking capacity over the past 30 years.

This progress has helped to stimulate the next big push and to justify it on both economic and environmental grounds. In January 2006, California kicked off the nation's most aggressive energy efficiency program, which will provide $2 billion in funding over the next three years. The state estimates that the investment will return nearly $3 billion in net benefits to the state's economy. The benefits include averting the construction of a 500-MW power plant each year and avoiding over three million tons of CO_2 emissions.

The state's regulators have recently adopted a plan requiring utilities to invest in energy efficiency whenever it is cheaper than building new power plants, and requiring that the savings attributed to energy efficiency be rigorously measured and verified.





is the best way to increase overall efficiency while also lowering the cost of electricity production. Unfortunately, most rates today are bundled rates—averaged across many customers and time periods—so consumers have no incentive to shift their energy use to more-economical, off-peak periods. According to Jeremy Bloom, EPRI's manager of power delivery asset management, "Most economists will say that until you create a pricing scheme that reflects the cost of energy by time of day or year, you won't have sufficient incentives for efficient energy use."

For regulators, end-use energy efficiency can be viewed as a tool to help expand the portfolio of options, create new capabilities and functionality in the power system, establish a more dynamic partnership between utilities and their customers, and respond to the global societal imperative of reducing greenhouse gases. Achieving these goals will require a renewed business model that goes beyond strictly selling electricity. Today's viable business models will have the following functions as well:

- removing the disincentive of lost revenues so that the utility does not lose money by selling less electricity
- providing incentives to promote energy

efficiency and demand response goals, such as allowing utilities to earn a rate of return on capital investments for efficiency
- placing energy efficiency resources on a competitive platform with new generation investments.

Innovative Markets

The deregulation experiments of the late 1990s led to broad-scale restructuring that redefined energy markets substantially. In some states, traditional utility functions were split, with power companies prohibited from producing the electricity they provided to customers. Such moves to promote competition separated generation investment decisions from the obligation to serve customers and changed electricity markets on both the wholesale and retail levels. Absent regulatory incentives, many utilities froze funding for programs that would reduce their ability to compete on a least-cost basis, and energy efficiency spending plummeted.

Strengthening or reinstatement of utility customer programs could provide important marketplace stimulation for efficiency goals. Energy audits, insulation programs, equipment servicing, rebates, buyback programs, and low-interest loans have all been effective in promoting efficiency in retail markets. Trade ally cooperation with home builders, contractors, service companies, and trade groups can further encourage the public to choose efficient appliances and equipment.

However, in terms of retail market offerings, emerging third-wave communication and device technologies will provide much-improved visibility and transparency on how value can be derived from efficiency and demand response. Dynamic systems will create a platform for creative new value offerings that will benefit both energy consumers and energy providers. Obvious possibilities will be time- and quality-differentiated rates and the easier purchase of nontraditional options such as green power or even "negawatts." With prices-to-devices capability, customers could be offered opportunity pricing for deferrable loads such as dishwashing or clothes washing. Essentially, power marketers will be able to respond to consumers' growing interest in customizing their purchases by allowing them to help design their own energy service packages through the smart meter–enabled consumer portal.

Wholesale market design features are also important, since they influence the vigor of competition, the accuracy of price signals, and the degree of coordination achieved among institutions on the supply side. And future innovations in market design must not introduce unintentional risk. In particular, designs must ensure that generation and transmission remain reliable and well coordinated, daily operations be immune to gaming and abuses of market power, and financial risks be well managed to enable the system to sustain exogenous shocks. Further, some mechanism must be found to provide adequate incentives for investment in generation and transmission and to ensure enough capacity margin to reduce price volatility.

Considerable work remains to be done before market designs can be successfully implemented:
- analyzing the successes and failures of recent power market experiences
- designing restructuring plans that minimize the overall risk of systemic failures
- ensuring efficient allocations of risk, especially financial solvency of default service providers
- mitigating market power to ensure generation adequacy
- creating and maintaining the market pull that will support these solutions.

The Value of Demand Response

	The Customer Perspective	Customer Service Impact	Purpose of Demand Response	Valuing Demand Response
5	Full Outage	Total Loss of Service	System Protection	Full Outage Cost
4	Involuntary End-Use Curtailment	Loss of End Use	Grid or System Protection	Expected Value Partial Outage Cost
3	Voluntary Partial End-Use Curtailment	Some Comfort Impacts	Reliability and Economics	
2	End-Use Shifting or Rescheduling	No Noticeable Impacts	Economics	kW
1	Basic Service	None	None	kWh

Demand response has multiple dimensions of value at different levels of customer concern. Moving up from the supply of basic services, the purpose of demand response progresses from economic savings, in terms of kilowatthours of energy and kilowatts of capacity, to system reliability and protection against outages. (Source: Lawrence Berkeley Laboratories)

Restructured wholesale markets will inevitably transform a utility's role at the retail level. Notably, the regulatory compact's "obligation to serve," which characterized the previous era, may be recast to become an obligation to serve *at a price.* To protect consumers, regulators may require that a minimal service contract be offered as a default option, especially for residences.

The design of new markets and contracts will require a flexible regulatory approach and commitments on the part of all market participants to address the challenges of implementation. Markets will require new forms of service contracts, offered in a menu of options that can gain market share relative to current default minimal service. Designs are also needed for programs that offer provisions for insurance, curtailment, risk hedging, and other features.

Increasing Customer Satisfaction

While high-tech innovative systems may very well define the future of utility-consumer relationships, nearer-term opportunities to increase energy efficiency abound. In fact, energy efficiency technology available today can play a strategic role in increasing customer satisfaction—helping to maintain current customers and attract new ones—and can generally provide customers with more value for the energy they use.

What hasn't changed since the 1970s is that utilities are in a key position to deliver energy efficiency programs. "When we ask customers whom they rely on for energy efficiency information, they point to us," says Salt River Project's Richard Hayslip. "And I know we're not unique in this. Utilities are well positioned to be at the center."

Industrial and commercial customers seek efficiencies as a matter of economic survival, and they value energy providers that can help them compete. Justin Bradley serves as energy director for the Silicon Valley Leadership Group (SVLG), which represents some 200 well-respected employers in California's Silicon Valley region. "For commercial and industrial customers, voluntary energy efficiency has already decreased the carbon intensity of our economy enormously," he states. "This doesn't require a command-and-control regulatory approach. Instead, our motivation is economic sustainability in alignment with environmental and quality-of-life goals. Without sound economics, there is no *sustain* in sustainability." SVLG is currently collaborating in a partnership that includes local governments, nongovernmental organizations, academia, and businesses—including Pacific Gas and Electric Company—with a goal of voluntarily reducing CO_2 emissions in the region to 20% below 1990 levels by 2010.

Utilities can play a significant role as systems facilitators, offering new insight to system designers and helping commercial and industrial customers realize the greatest efficiencies systemwide. And the system may very well include the building itself. According to Marek Samotyj, an EPRI program manager in the Power Delivery and Markets sector, "Customers all too often choose to upgrade a single process or piece of equipment. While it may save energy, that approach may not offer the greatest benefit, and it may even cause other problems down the line. A high-technology control system, for example, may be too sensitive to operate in an outdated systems environment because of different harmonic distortion levels or power quality requirements."

Dworkin suggests that a combination of information and pricing packages targeted to specific markets can be very effective: "Focus on the places of greatest energy use. In Vermont or Wisconsin, visit all the dairy farms. In the Gulf States, visit the people who distribute air conditioning. In Manhattan, talk to managers of large commercial properties and manufacturers of HVAC chillers."

Fundamental to marketing energy efficiency programs and products is a good understanding of the perceptions and motivations of target customers, many of whom today are feeling the pinch from their energy bills. "For years we've been encouraging people to set back their thermostats," says Krause. "With the rise in the cost of energy, we've found that a certain set of people are motivated by tracking their utility bills to see if they can use less. We're sending our customers two years of data detailing how much energy they've used. They find this so interesting—I've had more people tell me this—they set up family contests to see who can figure out how to save the most. We wouldn't have gotten their attention if the price of natural gas weren't so high."

An unusual offering by Salt River Project is a prepay program whereby customers buy electricity in advance, put it on a card, and use that card to recharge their meter, so to speak. A device in the home tells them how much electricity they have left on the card; they can make adjustments to maximize their energy use; and most important, their use is communicated in dollars. "It's a clear signal to consumers how much electricity they're using and how much they have left," says Hayslip. "It forces them to pay attention, and they tend to use a lot less electricity." The program was initiated for people who had credit problems, but it was expanded to include individuals who want to closely monitor their electricity expenditures. It now serves 40,000 customers.

Independent of approach, all agree that this is the time for action. "Energy demand is on the rise, and energy prices are increasing," says Munns. "Energy efficiency is the least expensive and most environmentally friendly way to approach adequacy and price issues. It will not replace the need for new infrastructure and supply, but it has a definite role."

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