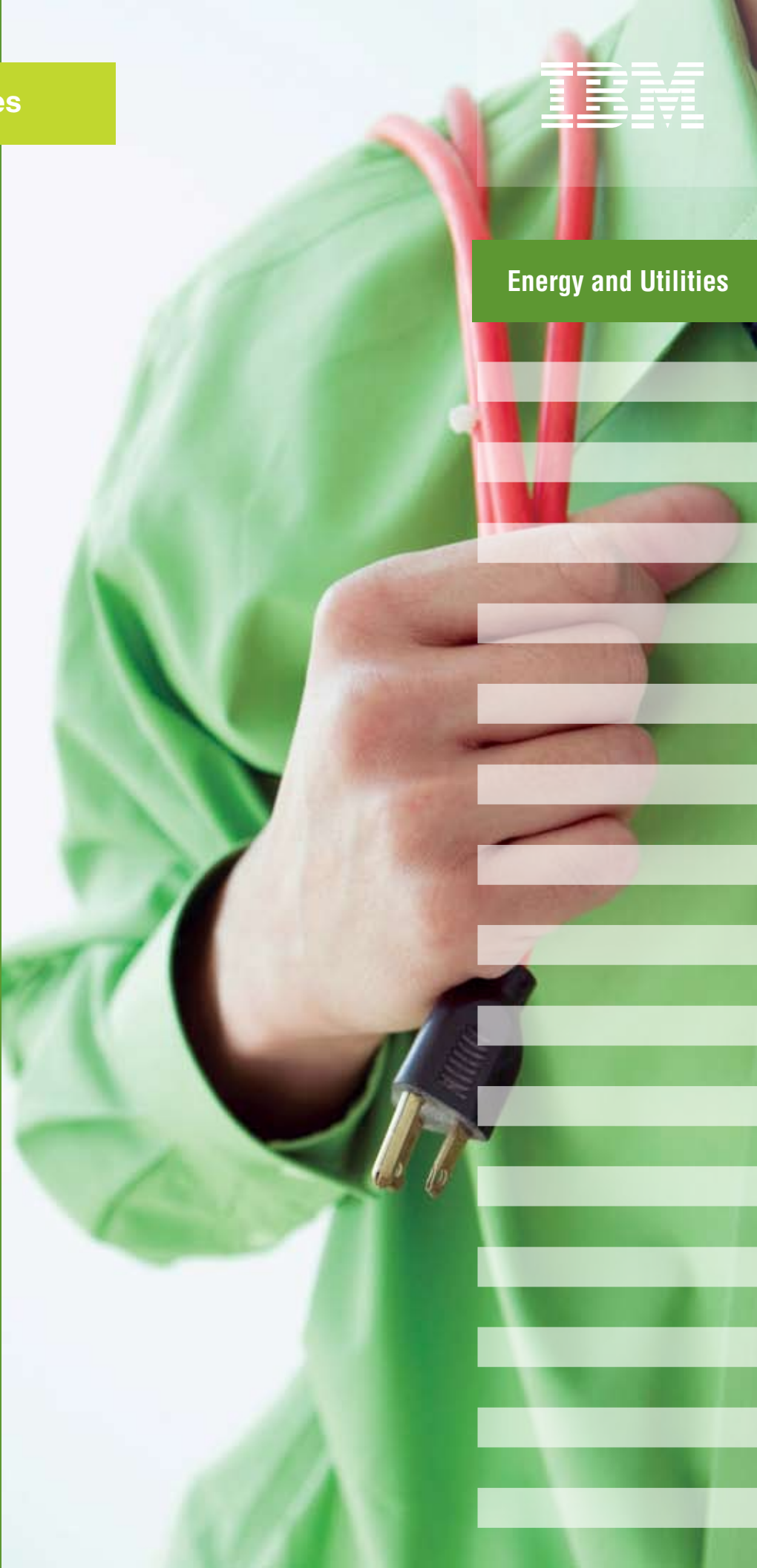


Plugging in the consumer

Innovating utility business
models for the future

Energy and Utilities



IBM Institute for Business Value

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Plugging in the consumer

Innovating utility business models for the future

By Michael Valocchi, Allan Schurr, John Juliano and Ekow Nelson

Historically, the relationship between utilities and consumers has been rather lopsided – utilities had the power, both literally and figuratively. But the confluence of climate change concerns, rising energy costs and technology advances leading to greater consumer involvement is now radically redefining that relationship. Our recent surveys of 1,900 energy consumers and nearly 100 industry executives across the globe reveal major changes underway – a more heterogeneous consumer base, evolving industry models and a stark departure from a decades-old value chain. We believe companies need to prepare now for a participatory network that enables customers to choose from a wide variety of suppliers, actively manage their consumption and even sell back surplus power they generate.

Introduction

In decades past, as long as the energy flowed when and where required, residential and small commercial customers were satisfied with leaving all the decisions about their energy supply to their trusted providers, even if they were unhappy with the bill.

But times have changed. Growing reliability concerns, fear for the environment's future, and ever higher energy bills have some consumers wanting to manage more of their energy

supply decisions themselves. If utilities and regulators allow them to be more active participants, these customers are willing to shoulder more responsibility.

Given this shift in consumer attitudes and the rapid advancement of new technologies, what will the industry look like in five to ten years? How quickly will utilities and regulators respond to these emerging consumer needs? And how much control do consumers really want?

To help answer these kinds of questions, we surveyed 1,900 consumers from six countries in mature economies.¹ In our “consumer” group, we included residential households and small commercial customers, but excluded large commercial and industrial companies. We also interviewed nearly 100 industry executives in Europe, North America and the Asia-Pacific region – one-third from large firms with revenues greater than US\$5 billion and the remainder from smaller utilities.²

Based on the insights from our consumer survey, interviews with utility executives and our own industry experience, we anticipate a steady progression toward a Participatory Network, a technology ecosystem comprising a wide variety of intelligent network-connected devices, distributed generation and consumer energy management tools. Although the precise timeframe for reaching this end-state is unknown, our research suggests a few major milestones. Within five years, the percentage of the world’s electric utilities that will be generating at least 10 percent of their power from renewable sources will have doubled. In that same timeframe, we believe sufficient supplier choice will allow meaningful consumer switching to emerge in most major competi-

tive markets. Also, based on both consumer and utility responses, we expect utility demand management initiatives to expand dramatically and electric power generation by consumers to make tremendous inroads within ten years.

Leveraging the new technology ecosystem will help utilities harness innovation to meet key objectives in coming years, including:

- Preparing for an environment in which customers are more active participants
- Capitalizing on new sources of realtime customer and operational information, and deciding which role(s) to play in the industry’s evolving value chain
- Better understanding and serving an increasingly heterogeneous customer base.

The utility industry is fast approaching a tipping point beyond which consumers can, and increasingly will, demand equal footing with their providers. Those utilities that are fully prepared to share responsibility with their customers and help them meet their specific energy goals will have a significant competitive advantage.

Plugging in the consumer

Innovating utility business models for the future

Consumers have become increasingly committed to involvement in media and entertainment, and may follow this example in the energy industry.

Does YouTube infer “YouEnergy”?

Thanks to technology advances and a contagious groundswell of empowerment, industry by industry, “consumers” are taking on much broader, more involved roles than that term implies. Not only are they increasingly vocal and decisive about what they will or will not consume, they are, in many cases, moving back in the supply chain – becoming designers, producers, marketers and distributors of the products they once just purchased.

If it's difficult to imagine that trend moving to the energy industry, consider the changes in the media and entertainment business in recent years. Although these two industries are very different in many ways, consumer involvement in the energy business could follow many parallel paths.




Looking back, consumers in both industries started out as passive participants. Energy consumers used whatever type of energy their utility sent to the premises without worrying about how it was generated or the consequences of their consumption. Television viewers acted just as passively – watching whatever programs networks happened to be broadcasting on one of the few limited channel options at any given time. Control sat firmly in the hands of utilities and broadcasters.

But, in recent decades, the media and entertainment business has changed dramatically. Cable and satellite provided viewers with hundreds of additional channel choices and niche programming. More recently, options such as digital video recorders, video on demand, video programming on mobile devices and online libraries of content have emerged, giving consumers more control over what, where and when they watch. Now, pockets of media enthusiasts are taking on new, more participatory roles – even producing their own content. The evidence of this evolution is quite clear in media – and, with the right conditions, a similar pattern could unfold in the utility industry (see Figure 1).

We believe the next five years will be pivotal for the energy industry. Consumer needs and roles are expanding, influenced to a large extent by the part consumers are now playing in other industries like media and entertainment. For utilities, this means revisiting long-held beliefs about how best to serve customers and making fundamental changes to their strategies and operations in preparation for a more participatory market.

Figure 1.

The rapid increase in consumer choice in industries like media and entertainment will shape consumer expectations for electricity providers.

	Television consumer	Electricity consumer
Passive 	<ul style="list-style-type: none"> • Passive receipt of content • Limited sources of content generation • Major media companies exclusively control content • Provider-customer relationship one-to-many, driven by demographics and geography 	<ul style="list-style-type: none"> • Passive receipt of power • Limited sources of power generation • Incumbent utilities exclusively control power generators • Provider-customer relationship one-to-many, driven by demographics and geography
Active 	<ul style="list-style-type: none"> • Consumer interest drives new and more targeted choices in content • More interest in and leverage of information on quality indicators for content (e.g., TV program rating systems) • Broader choice of providers drives more active role in provider selection • Consumer does not control content, but has stronger influence via choices • Introduction of time-shifting technologies enables more active selection and management of content at individual level 	<ul style="list-style-type: none"> • Consumer interest drives new and more targeted choices in power supply • More interest in and leverage of information on quality indicators for content (e.g., green energy standards) • Broader choice of providers drives more active role in provider selection • Consumer does not control generation, but has stronger influence via choices • Introduction of residential time-of-use programs and green power options enables more active selection and management of generation deployment at individual level
Participatory 	<ul style="list-style-type: none"> • Interactivity and involvement with content and service providers increases • Consumers active in producing content and influencing content distribution • Rapid creation of new content types as technology change causes explosion in capabilities • Dynamic, value-based pricing of content • Provider-customer relationship dynamic is increasingly customized to specific entertainment and information interests, with consumer analytics a key driver 	<ul style="list-style-type: none"> • Interactivity and involvement with generation and service providers increases • Consumers active in generating power and influencing generation planning decisions • Rapid creation of new power supply options as technology change causes explosion in capabilities • Dynamic, value-based pricing of power (e.g., time-of-use) • Provider-customer relationship dynamic is increasingly customized to specific energy management goals, with consumer analytics a key driver

Source: "The end of television as we know it," IBM Institute for Business Value, January 2006; IBM Institute for Business Value analysis.

Converging catalysts

Climate change concerns, technology advances and consumer involvement are the key factors driving the industry toward this new environment. Collectively, these drivers are overturning traditional assumptions about

energy consumers and the fundamental value proposition of the industry itself. Though each of these trends has progressed independently for a time, they have all now reached a point of convergence where each is fueling the others and the entire combination is catalytic.

Almost 40 percent of consumers who can choose renewable energy do so – and more than 60 percent of those who do not currently have those options would like them.

Climate change concerns

In recent years, the debate over climate change has become much more public. Messages about the potential for dramatic climate change, at least in part due to greenhouse gas (GHG) emissions, have started to resonate with the average consumer. This drumbeat has increased rapidly to near-deafening levels. In 2003, 119 articles on climate change appeared in the top 50 US newspapers. By 2005, that number had skyrocketed to more than 1,800. And in just the first seven months of 2007, more than 3,400 such articles have been published.³

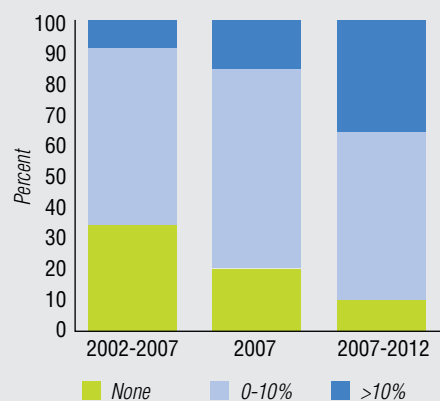
Around the world, governments are responding with new energy policies, programs and legislation. Governmental and regulatory pressures on utilities are particularly intense in Europe and North America (where 79 percent of executives rated the pressure as moderate to strong). In Asia Pacific, firms are feeling less pressure (only 38 percent indicated pressure was moderate to strong) – but this may change as sentiments from other regions spread through the global marketplace.

Consumers are clearly interested in the environmental practices of those they do business with, from consumer brands to energy providers. Seventy percent of the consumers we surveyed said environmental considerations were already an important factor in choosing products other than energy, and these concerns also influence the energy products they buy. One in five consumers knew about renewable energy options available to them through their current electric providers; of those, almost 40 percent purchased some or all of their power under such a plan. Among those who currently do not have (or are not aware of) the option of choosing renewable power sources, more than 60 percent expressed interest in doing so.

Outside the United States, one out of every four consumers we queried had computed the climate change impact of their energy usage.⁴ The message is clear – more people are willing to take personal responsibility for their own energy consumption consequences.

Utilities are making major investments and operational changes to respond to climate change concerns and policies. Within five years, both the percentage of utilities devoting at least 10 percent of their capital expenditures to environmental compliance and the percentage of generating companies securing more than one-tenth of their power from renewable sources will double (see Figure 2). And where consumers are less inclined to take steps to limit the impact of their energy consumption on the environment, utilities may be increasingly forced by regulators to take on that responsibility – through better demand response, higher efficiencies, extending the lifetime of existing infrastructure through better asset management, and other system-wide improvements.

FIGURE 2.
Industry executives' estimates of total sales from renewable power sources – five years ago, now and five years from now.



Source: IBM Institute for Business Value/Economist Intelligence Unit 2007 Utility Industry Executive Interviews.

Technology advances

To make these improvements, utilities will likely deploy advanced energy technologies such as smart metering, sensors and distributed generation. Many of these have been available in some form for years, but their business cases have been rather lackluster. However, during the last three to five years, the technologies have continued to advance, and their benefits have strengthened dramatically. Several contributing factors are prompting greater interest in advanced technology deployment:

- The combination of energy price increases and consumers' increased sense of responsibility for the impact of their energy usage on the environment have generated serious interest in managing consumption.
- The frequency and extent of recent blackouts are driving consumers, politicians and regulators alike to demand assessment and upgrade of the industry's aging network infrastructure. In addition, the steady flow of retirements resulting from the industry's aging workforce makes it difficult to retain the skills necessary to maintain today's labor-intensive network.
- Climate change concerns have invigorated research and capacity investments in small, clean generating technologies. At the same time, rising and unpredictable fossil fuel prices are making these technologies more cost-competitive.
- Technology costs have generally decreased as lower-cost communications, more cost-effective computing and open standards have become more prevalent.

Given this backdrop, we see smart meters, network automation and analytics, and distributed generation driving the most industry change, from a technological perspective, in the near term.

Smart meters can provide motivated consumers with the decision-making information they need to better manage consumption and energy costs. When combined with programs that leverage this information (e.g., time-of-use pricing), shifts in consumer behavior can be significant (see sidebar, *With the right programs, interested consumers can reach their energy goals*). In addition, remote control of energy-consuming devices offers consumers an extra measure of convenience and control. Smart meters also benefit utilities in several ways, such as providing better demand management/load response capabilities and allowing companies to turn on or shut off service remotely, reducing labor requirements.

The movement toward an intelligent network that leverages *network automation and analytics* in conjunction with grid data devices such as smart meters provides further benefits to both utilities and consumers. Sensors and automated monitoring mean fewer outages and faster restoration. Optimized transmission of power can shorten transmission paths and reduce losses, which lowers overall generation needs – all of which amounts to lower GHG emissions. A more sophisticated network also enables new products and services that take advantage of realtime consumer information and two-way interaction as these become available.

Smart meters, network automation and analytics, and distributed generation are expected to drive substantial industry change over the next few years.

With the right programs, interested consumers can reach their energy goals

In cooperation with Hydro Ottawa, the Ontario Energy Board recently completed a seven-month pilot that tested consumer inclination to shift and reduce demand when using smart meters and time-of-use pricing. The 375 Hydro Ottawa residential participants were divided into three groups. Roughly one-third were assigned a basic, off-/mid-/on-peak time-of-use plan (TOU); another third were on the same general plan but had a penalty for critical peak usage (TOU+CPP); and the final third used the basic plan supplemented with a rebate for avoiding critical peak usage (TOU+CPR).⁵

To help with monitoring, consumers were supplied with monthly usage statements in addition to their regular bills. They also received refrigerator magnets that outlined timeframes and associated prices for their particular plan.

On average, 75 percent of participants shifted enough of their consumption away from peak times to save 3 percent per month on their energy bills. During four peak summer events, when penalties and rebates applied, shifts in consumption led to even greater savings – 6 percent for TOU, 25 percent for TOU+CPP and 18 percent for TOU+CPR.⁶ These results are particularly remarkable given that consumers were relying on monthly usage statements; if consumers had a near-realtime view of usage, these reductions might have been even more dramatic.

Participants not only shifted demand, but also reduced total consumption. This “conservation effect” amounted to a 6-percent reduction in overall usage. When combined with the effects of shifting, this allowed 90 percent of the participants to pay less than they would have paid on their prior plans.⁷

When surveyed near the end of the pilot, 78 percent of the consumers said they would recommend this type of program to a friend, and less than 20 percent wanted to revert to a traditional pricing plan.⁸

Utilities are also adding smaller, renewable *distributed generation* facilities to their supply mix in an effort to further reduce the impact of power generation on climate. But the potential for consumers to begin to generate power locally is what truly positions distributed generation as a technology that can dramatically change the way both utilities and consumers meet their energy, environmental and economic goals. Once meaningful numbers of consumers and utilities incorporate these units into the overall supply infrastructure, availability will increase, and outage risk will decrease.

Among our industry executive respondents, 64 percent believe at least one small, clean, advanced generation technology will become widely deployed among residential and small commercial customers within ten years. However, we believe regulatory incentives and support may be necessary to accelerate deployment in the short term; where they exist, adoption has been impressive (see sidebar, *Regulatory incentives spark consumer adoption*).

Regulatory incentives spark consumer adoption

The spectacular growth of residential renewable energy systems in Germany demonstrates strong evidence of the tangible impact of regulatory support for distributed generation. Through a combination of low-interest loans and favorable tariffs for sale of power from renewable generation back to the grid, renewable energy sources contributed over 70 billion kilowatts in 2006, which is over 11 percent of the nation's total electricity consumption.⁹

In 1999, the German government made available low-interest loans for renewable electricity generation equipment. The following year, they put in place the Renewable Energy Sources Act (EEG), which allowed homeowners and farmers to connect their power systems to the grid and provided them a fair price for their surplus electricity. While this created some additional interest, an amendment to the EEG in 2004 boosted power sell-back prices by 25 percent, causing investment to skyrocket.¹⁰ Between 1999 and 2003, the number of residential installations of photovoltaic power systems grew steadily at a CAGR of 88 percent, but in 2004, installations shot up by 233 percent.¹¹

In 2006, Germans invested more than US\$10 billion in new sources of renewable energy, setting a world record. Germany now operates more wind-powered generation, more solar systems and more biogas plants than any other nation worldwide.¹²

Consumer involvement

The move to renewable self-generation seen under Germany's EEG is but one indication that consumers are striving to level the playing field with their energy providers. They are looking to a combination of four activities to make this happen: leveraging provider choice options, more actively managing their usage, moving toward self-generation of power and making their opinions heard through multiple channels, not just regulators.

Controlling their purchases

In some regions with competitive markets, consumers are exercising the right to select their energy providers. In Great Britain's market of 48 million electricity consumers, for instance, more than 20 percent are switching per year.¹³

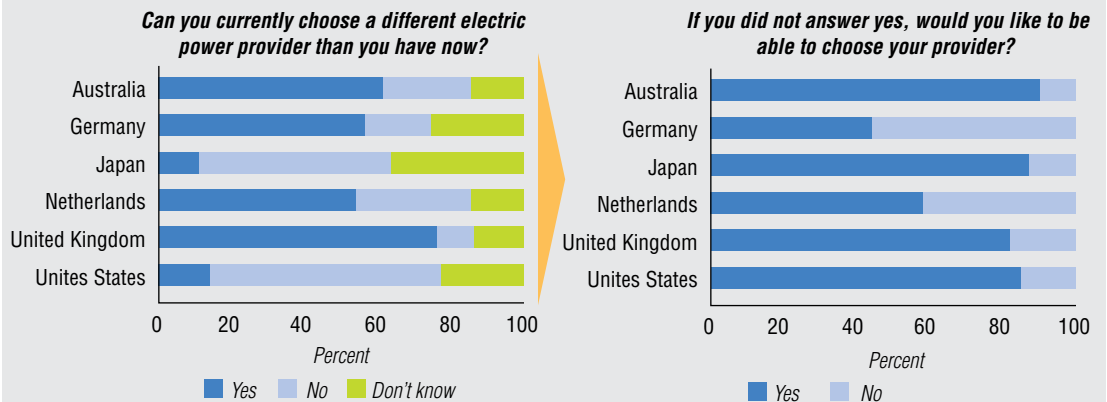
However, even where competitive markets are in place, most countries still lack adequate mechanisms to encourage movement.

Poorly implemented regulatory policies can complicate the process for consumers and new competitors. Other barriers include: charges levied for switching, limited number of competitors in a particular geography, lack of consumer interest (often from inadequate information and education) and long notification periods (some countries require customers to notify providers of their intent to switch more than one year in advance).

In addition, our survey shows that a basic lack of awareness may still be holding consumers back. Across our worldwide respondent sample, one out of every five consumers did not know whether they could choose an alternative electricity provider.

Nevertheless, consumers were clear about wanting a choice. Among those who could not change providers or were not aware of their ability to choose, the vast majority (84 percent) wanted the option (see Figure 3).

FIGURE 3.
Consumer interest in provider choice.



Source: IBM Institute for Business Value 2007 Utility Consumer Survey.

Consumers are asserting more control by choosing particular providers and products, actively managing their consumption, making their voices heard directly, not just through regulators – and, in some cases, generating their own power.

While price will always be a factor, competition is also bringing to the fore a host of decision-making criteria that consumers may not have even thought about before. Our survey results indicate that consumers now consider a utility's ethical reputation, alignment with community values, and environmental actions on par with traditional "buyer values" like customer service and reliability.

Along with choosing a provider, consumers have more choices about the type of energy they buy. One-third of our respondents were not interested in paying more for cleaner power, but over 40 percent would agree to pay a *slightly* higher price (5 percent more). A significant minority – one in five consumers – indicated willingness to pay at least 20 percent more for an environmentally friendly product.

Controlling the switch

Only 30 percent of the consumers we surveyed expect their electricity use to increase over the next five years – and yet 60 percent expect higher electricity bills. In times of rising energy costs, the motivation for conservation is high.

But with many consumers also assuming their share of the responsibility for protecting the environment, finding new ways to reduce consumption has become a top-of-mind issue.

Although consumers have always been able to *reduce* usage through "brute force" measures – adjusting thermostats, switching off lights and the like – they are just now gaining the ability to truly *manage* consumption through greater awareness and better tools. As smart meter deployment allows more consumers to obtain realtime usage data at the device/appliance level, households and small businesses will *know* which conservation actions really make an impact. This will enable better decisions and more permanent behavior changes.

Controlling supply

When providers are not willing or able to satisfy their needs, consumers have an increasingly viable alternative...the technological means to generate their own electricity.

As consumers weigh the self-generation option, cost is clearly a significant driver, but not the only one (see Figure 4). If self-generation could reduce energy costs by 50 percent, well over half of the consumers we surveyed would be motivated to install, maintain and operate their own power generation systems. And yet, among those same respondents, reliability and environmental impact seemed to matter more than a *small* (10 percent) cost reduction.

Interestingly, getting paid for surplus power received the most favorable reaction from our respondents. Besides offering a financial payback that helps offset upfront investment and operational expense, we suspect that this response also reflects an underlying desire to assert more control and influence over a purchase for which the conditions have historically been dictated to them.

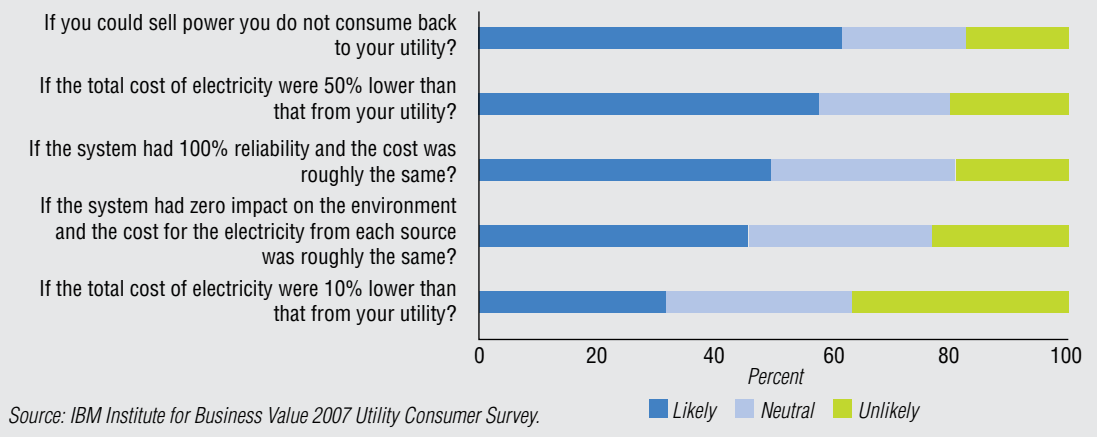
Many of the industry executives we interviewed agree that widespread adoption of self-generation is not that far off. More than half believe that the value from a low-cost, low-emission generating technology could move a significant percentage of residential and small commercial customers to self-generation within the next decade.

Controlling their own destiny

Blackouts affecting millions of people, price hikes driven by factors not understood by consumers and the pursuit of mergers and acquisitions without clear customer benefits are all contributing to growing consumer skepticism – not only about utilities and their motives, but also about the regulatory process that’s been put in place to protect the public. Consumers are increasingly unwilling to wait for regulators to act “in their best interests.” Frustrated, they are going directly to lawmakers, the press and special interest groups to force change.

For example, in January 2007, a 1997 Illinois deregulation bill expired, ending a ten-year rate freeze. As the shock of a sudden and dramatic rate increase set in, public pressure caused legislators to intervene – ultimately driving the state’s primary distribution utilities to provide a multiyear, billion-dollar rate relief package to help reduce the financial burden on ratepayers.¹⁴

FIGURE 4.
Consumers interested in installing, maintaining and operating their own power generation systems.



When it comes to energy decisions, consumer behavior seems to hinge most on personal initiative and disposable income. This kind of examination reveals four major consumer segments: Passive Ratepayers, Frugal Goal Seekers, Energy Epicures and Energy Stalwarts.

Industry impacts

We expect these three converging trends – climate change concerns, technology advances and growing consumer involvement – to have far-reaching consequences for the utility industry. Companies will be forced to look at their residential and small commercial customer population in discrete segments instead of as a largely uniform block of rate-payers. Engaged consumers and advanced technology will pull the industry toward a participatory network model in which information flow will multiply. This, in turn, will create a host of opportunities for achieving greater efficiency, providing additional products and services and pursuing new business models.

A new kind of segmentation

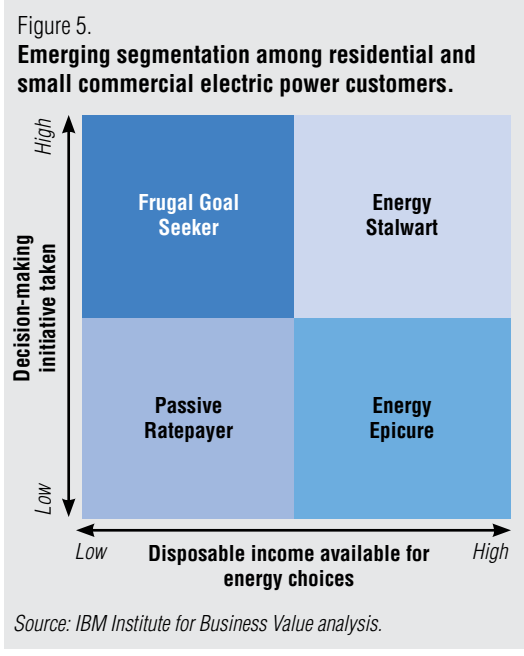
Historically, residential and small commercial customers were generally viewed as homogeneous groups, distinct from large commercial and industrial customers, but not typically categorized any further. Our research, however, suggests this practice may no longer be appropriate.

In our consumer survey, two main attributes were associated with the greatest variances in consumers’ behavior patterns:

- Personal initiative – The willingness of a consumer to make decisions and take action based on specific goals, such as cost control, reliability, convenience and climate change impacts
- Disposable income – The consumer’s financial wherewithal to support energy-related goals; in early adoption phases, only those with sufficient resources will be able to implement new technologies and buy more expensive products.

Using these two differentiators, we divide the residential and small commercial customer set into four main consumer segments (see Figure 5):

- Passive Ratepayers – Consumers who are relatively uninvolved with decisions related to energy usage and uninterested in taking (or unable to take) responsibility for these decisions
- Frugal Goal Seekers – Consumers who are willing to take modest action to address specific goals or needs related to energy usage, but are constrained in what they are able to do because disposable income is limited
- Energy Epicures – High-usage consumers who have little or no desire for conservation or active involvement in energy control; these consumers are more likely to own a large number of high-consumption devices for gaming, computing or entertainment
- Energy Stalwarts – Consumers who have specific goals or needs related to energy usage and have both the income and desire to act on those goals.



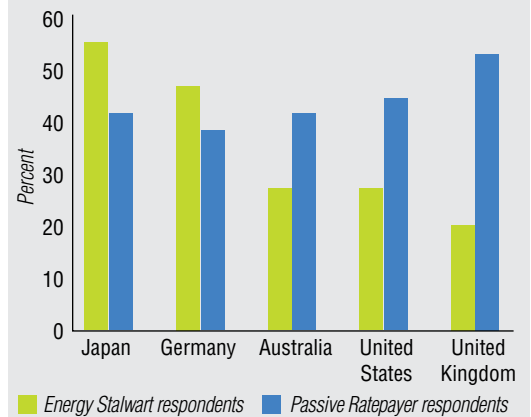
Passive Ratepayers were the most populous group in our sample – and will likely remain so in most countries for the foreseeable future. This group has the highest percentage of “don’t know” answers by far. They also have the most pessimistic outlook about future price increases; while only 24 percent believe their usage will increase over the next five years, 51 percent expect to see their monthly bills rise. This could be because their “passivity” makes them feel powerless to hold energy prices down. These two results, in combination, seem to suggest significant opportunities for educating this segment of consumers.

Frugal Goal Seekers value short-term conservation as a means to achieve some energy-related goals (e.g., reduce carbon footprint), but only when it can be achieved at little or no expense. By default, many low-income consumers fall into this category, but environmentally focused middle-income households end up here as well because of the high cost of renewable energy options. Understandably, because of income constraints, the respondents in this group were the least likely to consider installation of a distributed generation unit, regardless of the benefits posed in each question.

Energy Epicures have little motivation to limit consumption. In fact, over 75 percent of this group expects their consumption to increase over the next five years, as compared to 25 to 35 percent in other segments. More than half of this group falls into the typically higher-spending age bracket of 25- to 44-year-olds.

Energy Stalwarts are the trailblazers for competitive choice, conservation and technology adoption. They typically exhibit one or more of the following characteristics: are environmentally conscious; have high reliability needs, for instance because of home electronics or healthcare monitoring devices; or express interest in long-term savings and/or less dependence on their utilities. In every benefit scenario we asked about, between 30 and 50 percent of this group said they were “very likely” to deploy self-generation technology, which is a higher rating than any other segment. Interestingly, Energy Stalwarts actually outnumber Passive Ratepayers in two of the six nations where we surveyed – Japan and Germany (see Figure 6).

FIGURE 6.
Number of Energy Stalwarts as compared to number of Passive Ratepayers.



Source: IBM Institute for Business Value 2007 Utility Consumer Survey.

Note: The Netherlands could not be included in this chart due to insufficient data.

Over the next decade, we believe the industry will be an amalgam of four different models, but will move steadily toward the Participatory Network.

Industry models

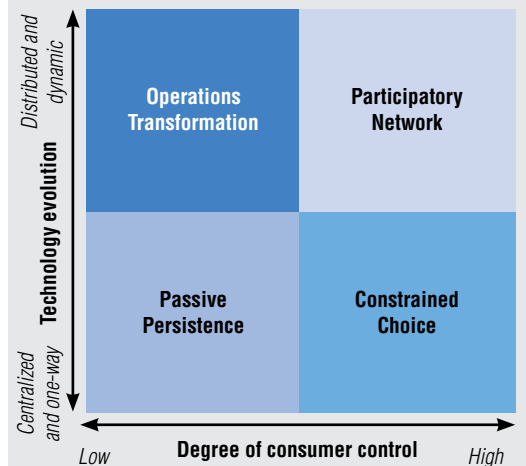
Based on our research, we believe the two factors that will have the most influence over the future of the utility industry are technology evolution and the degree of consumer control. At the lower end of the technology spectrum, power generation is centralized, and information and energy flow in only one direction. At the upper end, smart metering, enhanced network sensing and communications, and self-generation technologies create a dynamic consumption/generation network where information and energy flow in both directions. In terms of consumer control, one extreme represents a completely “utility-determined” relationship, in which consumers have very little say. The opposite extreme is a “customer-driven” experience, with consumers controlling major aspects of how they meet their energy needs.

Analyzing the impact of combinations of different levels of progression in these two areas suggests four industry models (see Figure 7). Though each one is described distinctly here, the industry as a whole – at least in the near term – will be an amalgam of all four.

- **Passive Persistence** – In this part of the industry, traditional utility market structures still dominate, and consumers either accept or prefer the historical supplier-user relationship.
- **Operations Transformation** – Here, some combination of grid and network technology evolves to enable shared responsibility, but consumers either cannot (or elect not to) exert much control. The balance of benefits from new technology deployment favors the utility.

- **Constrained Choice** – In this industry model, consumers take decisive steps toward more control, but are limited to certain “levers” (technologies, usage decisions or choices in providers) by regulatory and/or technological constraints.
- **Participatory Network** – This environment is characterized by a wide variety of grid and network technologies that enable shared responsibility. Consumers’ strong interest in specific energy goals creates entirely new markets (virtual and physical) and new product demands, which balances the benefits of new technology deployment more evenly between consumers and utilities.

Figure 7. **Four industry models, 2007 to 2017.**



Source: IBM Institute for Business Value analysis.

Despite the varying pace of change across regions, we see the movement toward a Participatory Network as inevitable – technology advancement and consumers’ appetites for control only march in one direction. However, the path the industry – both collectively and as individual companies – takes will be determined in large part by how rapidly technological, market and regulatory barriers fall. The evolution along the technology and consumer control axes will occur at varying rates in each market, with various regions operating under different models at any given time. For this reason, a utility with a service territory that spans multiple geographic areas might have to manage more than one model simultaneously – at least until a Participatory Network structure becomes widespread.

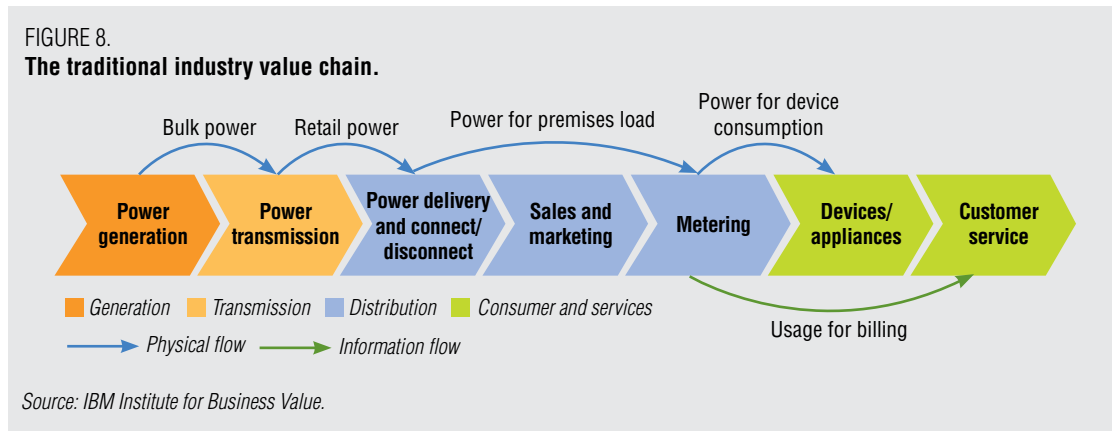
New information flows and new business model possibilities

As consumers sort themselves into segments with distinct needs and wants and the industry is pushed toward Participatory Networks, the fundamental nature of the utility industry is changing.

In the past, electricity was primarily generated in a centralized location, transmitted to the grid and eventually distributed to the end user.

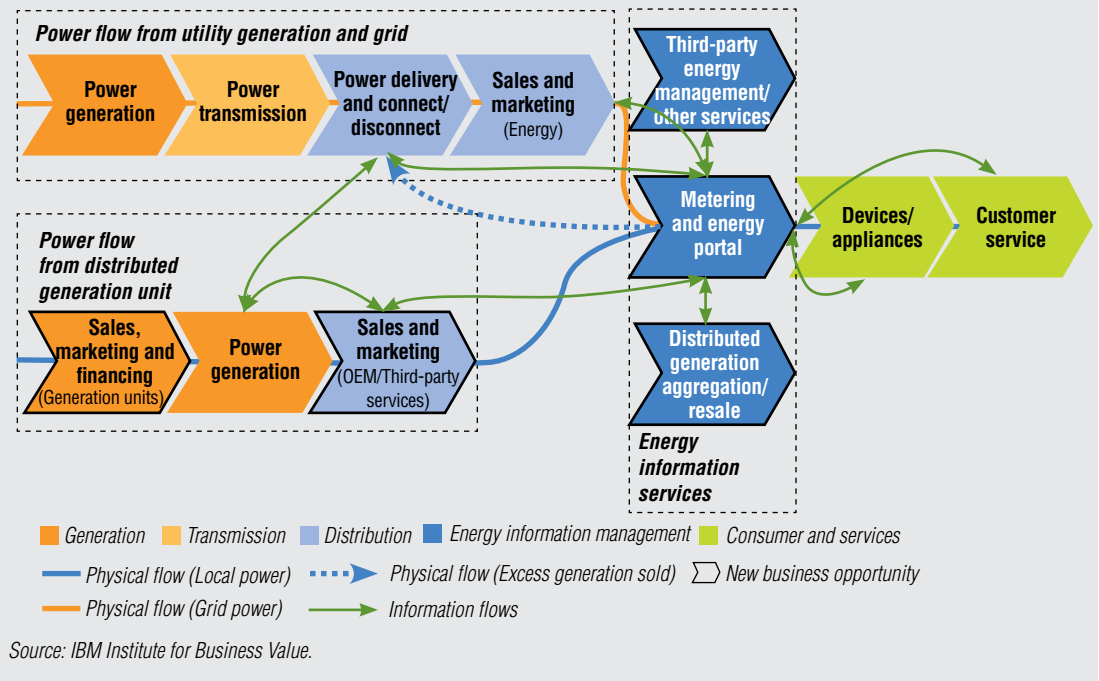
Businesses were defined by the part they played in getting electricity to consumers: generation, transmission, distributors, *et al.* The entire value chain was structured around power flow (see Figure 8).

But as generation decentralizes and smart meters and intelligent networks enable realtime data exchange, utilities will be forced to manage increasingly voluminous and complex new information flows in addition to energy flows. Historically, a utility’s primary information exchange with consumers was related to the monthly bill. But in a fully implemented Participatory Network, realtime data on consumer usage will be available, enhancing utilities’ ability to forecast and balance loads and offer targeted products and services to customers on a more individualized basis. Where distributed generation is in the mix, power from multiple sources will have to be metered, reconciled and billed. For these reasons, information flow will play a much greater role in shaping the industry value chain (see Figure 9). With the right regulatory framework, this information-rich environment could spawn a range of new products, services and business models.



As the environment becomes more participatory, utilities will need to manage more – and increasingly complex – information flows. But, with the right regulatory framework, a host of new business opportunities could emerge.

FIGURE 9. Dramatic increases in information flow could result in new business opportunities.



Recommended focus areas

So how can energy companies best prepare for this very different future? We suggest starting with development of long-term business and regulatory strategies for transitioning to a Participatory Network, the key elements of which will be creating a plan for capturing value from new consumer information flows and using customer analytics to gain a deeper understanding of consumers.

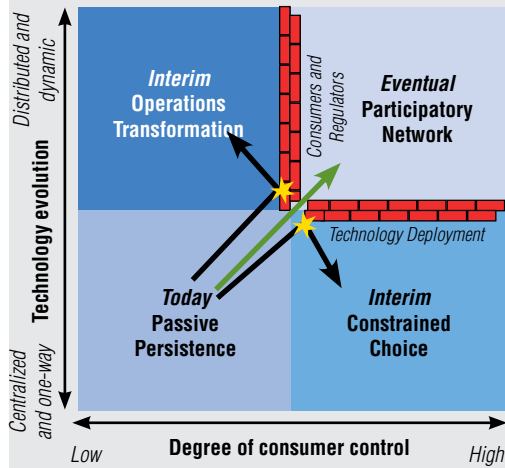
Transitioning to a Participatory Network

Based on our research and analysis of the utilities industry, we believe a full-fledged Participatory Network will ultimately emerge. Elements of such a network are already in place within several major markets. The question is not *if* a fully participatory environment will emerge, but *when*.

Even though some utilities may choose not to provide all of the capabilities inherent in a complete Participatory Network (ceding those roles to rivals or other specialized players) – they will still be part of the network. Consequently, utilities of all scopes and sizes should be prepared to be swept along into this consumer-driven, technology-enabled environment.

In the short term, various regulatory, economic, market and technological barriers will prevent many utilities from moving directly to a Participatory Network. The particular combination of factors a specific utility faces will instead push it toward one of two transitional paths: through *Operations Transformation* or through *Constrained Choice* (see Figure 10). Just like the electrons they deliver, utilities will move along the path of least resistance toward the ultimate destination: Participatory Networks.

Figure 10.
Most utilities will be blocked and forced down interim paths before reaching a Participatory Network.



Source: IBM Institute for Business Value.

Operations Transformation

A utility is likely to initially move to Operations Transformation when consumer control is blocked or impeded in some way. This could be as a result of a highly regulated market, insufficient competition in an open market or simply a lack of consumer education about available options. If primary fuel costs and/or carbon pricing are low, the price of fossil-generated power will flatten or drop, making renewables much less competitive and giving consumers less incentive to move from the status quo. Regulators may also be reluctant to provide adequate incentives and rate structures for technologies that encourage consumer involvement if there is a perception that consumer acceptance will be weak or that widespread deployment of technologies that enable greater consumer control might not yet be viable.

Utilities that find themselves in this type of environment can still benefit from moves toward a Participatory Network by leveraging available technologies to make operational improvements. For example, network analytics and automation can help utilities:

- Decrease maintenance costs and improve worker productivity
- Enhance asset performance and extend asset life
- Manage load more effectively and decrease long-term capital costs
- Improve reliability and shrink outage durations, reducing potential penalty costs
- Improve power quality
- Reduce transmission and distribution costs by lowering power losses.

Even where consumers cannot yet operate distributed generation, utility deployment of these units can help firms improve peak power availability and power quality and reduce total generation costs (especially if carbon constraints impose high costs and the distributed generation technologies are low- or zero-carbon generators).

This transitional period, while moving through Operations Transformation, is a window of opportunity in which utilities can work to improve efficiencies and lower costs. The ultimate goal is to improve their competitive standing in preparation for increased consumer involvement and the eventual move to a Participatory Network.

Constrained Choice

Utilities may be pushed toward Constrained Choice in the short term if technology deployment is delayed in one or more areas. These

In the short term, regulatory, economic, market and technological barriers may block movement toward a Participatory Network, in which case, utilities must migrate through either Operations Transformation or Constrained Choice.

holdups could be caused by a variety of financial, technological or regulatory reasons. For instance, certain technologies could be deployed more slowly than anticipated because of capital constraints or insufficient business cases. The lack of standardization could make the integration of network elements difficult. In addition, the regulatory environment may not be conducive to consumer involvement. For example, tariffs may not have tax breaks or sell-back provisions that promote self-generation.

In this environment, consumers may want more control, but their choices and capabilities are still limited. Although competition from new entrants will intensify, rivals will face the same barriers. This, in some sense, gives incumbent utilities “priority access” to the consumers that will be most receptive to new products and services. While temporarily confined in a Constrained Choice environment, utilities will need to take advantage of this access to strengthen their brands and prevent customer defection in the long run.

Customer analytics become critical in this state. Utilities will need to use whatever data is available to determine which consumers are most valuable and which are most likely to take advantage of participatory opportunities as they emerge.

Utilities will also have to evaluate new competitors and offerings. If the offerings are easily replicable by the utility, a rapid response can keep the utility “relevant” in consumers’ minds. If the offerings cannot be replicated, substitute offerings must be developed – or revenue models must be adjusted to reflect a world in which these customers have moved some or all of their business elsewhere.

After these assessments, a utility may elect to pursue one or more of the following actions:

- Position itself as an energy educator, advising interested consumers on how to navigate complex regulatory or market structures to meet their needs or showing consumers why certain behavior changes benefit them.
- Experiment boldly with new programs, particularly to address the needs of profitable consumers who may be lost to new entrants.
- Take the lead in pushing forward regulation that gets the Participatory Network rolling; where more active consumers are the most profitable ones, this helps gain their trust and support – and subsequently their future business.

By building brand and meeting as many needs as possible under the existing regulatory regime, utilities in Constrained Choice can position themselves as the provider of choice for their most profitable customers as new products and services become feasible.

Leveraging new information flows

As the industry moves toward a Participatory Network, information will grow increasingly more critical. As they transition through different industry models, utilities must consider what information is available and how they can best use it.

In Passive Persistence

Utilities operating in this environment lack much of the technology deployment necessary to capture realtime consumer usage data. Thus, they will generally be limited to information available from more traditional

analytics. Based on the information that can be gathered from bill analysis and in-place customer information systems, utilities can design programs that appeal to a broad base of consumers. As different programs are piloted, firms can collect customer feedback and track the profile of those interested to determine future direction for both technology deployment and customer programs.

In Operations Transformation

In this environment, utilities still have limited consumer involvement, but do have technology in place to access realtime energy data. These consumer load profiles can help utilities determine base-load and peaking needs for optimal generation, transmission and distribution capacity planning. This data can also be used to optimize consumer pricing (peak/off-peak) as well as wire-use charges levied on other bulk transmitters. Utilities can use improved location-specific outage and power quality information to proactively address incipient problems before they become customer satisfaction issues.

In Constrained Choice

Under this model, some utility consumers are interested in actively managing energy usage, but the necessary technologies may not yet be deployed. Utilities should consider ways to involve these motivated consumers in early adoption programs once consumer commercialization of the technologies begins. For example, they could allow consumers to explore distributed generation options facilitated by the utility or its business partners

or participate in smart meter pilots. The usage information collected from a limited set of highly active consumers can help firms build business cases for new products and services and technology deployment. Customer data analysis can help utilities identify and reach consumers who may be more profitable or more loyal if they are allowed to become more actively involved in their own energy management.

In a Participatory Network

When consumer participation is high and sophisticated technologies have been widely deployed, utilities will be able to develop rich and useful customer segmentation and behavior pattern data over time. They will also have realtime usage information from appliances, devices and distributed generation units that can communicate with the network. Customer analytics will become even more important as the wealth of information and the pressure from competitors and new entrants for the most profitable customers grow. These capabilities will allow utilities to develop valuable insights that lead to new programs and products that appeal to an expanding number of increasingly involved consumers.

Understanding consumers

Each evolving consumer segment has specific needs and wants, which means utilities need different strategies, and most likely different offerings, for each (see Figure 11). For Passive Ratepayers, utilities will need simple, uncomplicated offerings that require little effort on the part of the consumer. For example, a time-of-use pricing plan structured in large blocks of time (like mobile phone plans that offer cheaper rates after 9:00 p.m.) might encourage some of these customers to make slight adjustments in their typical consumption patterns.

Figure 11.
Differing needs will drive different approaches for each consumer segment.

	Passive Ratepayers	Frugal Goal Seekers	Energy Stalwarts
Technology leveraged	<ul style="list-style-type: none"> Traditional generation Traditional distribution networks 	<ul style="list-style-type: none"> Utility-owned renewables Low-cost (to consumer) intelligent network capabilities* 	<ul style="list-style-type: none"> Self-generation Utility-owned renewables Full-spectrum intelligent network capabilities*
Service packages	<ul style="list-style-type: none"> Traditional utility service Remote notification (Energy Epicures) 	<ul style="list-style-type: none"> Time-of-use program Efficiency incentives Subsidized programs 	<ul style="list-style-type: none"> Green power packages Grid power with backup power system Time-of-use program Remote notification
Communication	<ul style="list-style-type: none"> Targeted bill inserts (best candidates from customer analysis) Public education/mass media outreach 	<ul style="list-style-type: none"> Public education/mass media outreach Association/interest group messaging Financial incentives/assistance Product tie-ins Corporate social responsibility publicity 	<ul style="list-style-type: none"> Direct marketing Special interest media (magazines, Web sites) Association/interest group messaging Product tie-ins

* Intelligent network capabilities include smart meters as well as network automation and analytics
 Source: IBM Institute for Business Value analysis.

A one-size-fits-most customer strategy will no longer be sufficient – utilities will need different approaches that take into consideration the nuances of each segment.

Passive Ratepayers usually require little attention from their utilities. However, some utilities may decide it is worthwhile to attempt to move some Passive Ratepayers into another more energy-conscious category (Frugal Goal Seekers or Energy Stalwarts). For instance, if a utility’s transmission capacity is constrained or generation levels are approaching ceilings imposed by fixed capacity or emissions penalties, it may be advantageous to encourage a shift. Where this is the case, companies can either use mass-market techniques such as general public awareness campaigns or more precise actions such as targeted bill inserts. For these more targeted techniques, companies can use customer analytics to identify those consumers most likely to change if given sufficient education and incentives.

For Frugal Goal Seekers, utilities will need offerings and programs that require little or no financial investment from the consumer. This might include education on voluntary energy-efficiency actions (the use of high-efficiency light bulbs, programmable thermostats and other conservation techniques) and low-cost information devices. Because many Frugal Goal Seekers are interested in minimizing the environmental impact of their energy usage, utilities have an opportunity to access government subsidies for green energy choices that would be popular with this group. Time-of-use programs for this segment could have a more complex design, since these consumers are more committed and willing to be actively involved. Offerings that include financial assistance or incentives would appeal to this

group (including possible financing of major equipment purchases), as would product tie-ins such as energy savings associated with the purchase of a high-efficiency washing machine. This group may also be more attuned to public education and messages channeled through associations and interest groups. Many in this group are concerned about corporate social responsibility, and positive publicity in this area will be particularly important to retain these consumers in a competitive market.

Energy Epicures typically require very little effort to serve and could be a source of revenue growth as upper-end, digital homes proliferate. Utilities likely will want to stay the course with these happy and profitable consumers – unless transmission, environmental or other constraints are confronted. If a utility has reason to convert Energy Epicures into Energy Stalwarts, special programs will be needed to reach these high-use but conservation-averse consumers. For instance, a utility could partner with manufacturers of high-end consumer electronics to bundle an energy-efficiency package into the equipment purchase, effectively lowering the cost of the equipment. This group might also be intrigued by “leading-edge” convenience features enabled by the intelligent network, such as remote notification and control capabilities. To reach this group with conservation messages, companies will need to utilize specific channels these consumers frequent, such as mobile and Internet channels as well as clubs, events, social networks and media programming associated with gaming or sports. Promotion of distributed generation is feasible for this group, but the benefits would need to be

stated in a way that would catch Epicures’ attention and appeal to their desire to possess the latest in technology innovation.

Energy Stalwarts are arguably the most demanding of the four segments – but likely the most attractive customers in the long run. They want options and choices. They’re often interested in green power packages, self-generation, realtime pricing programs – and perhaps even access to the spot market to cover a shortfall in their own generating capacity. Their interests and higher disposable income also translate into a high likelihood of emerging as early technology adopters, which can be leveraged to bring costs down over time and make new technologies more economically accessible to a broader base of customers. One of the most valuable services utilities can provide to this segment is information – what options are available, where equipment can be purchased, how to estimate savings and costs and so on. Utilities can also offer this segment nontraditional services, such as financing, installation and maintenance for solar panels, micro-combined heat and power devices and other distributed generation equipment. To reach this audience, power companies should consider direct marketing, special interest media and social networking approaches.

But before utilities can begin tailoring their approaches to particular segments, most will need to invest in tools and capabilities that help them collect and analyze consumer data, particularly new information streams. Using these advanced analytical capabilities, firms can begin to calculate the profitability of particular segments. With these insights,

Before most utilities can tailor their approaches to particular segments, they will first need to build the capabilities necessary to uncover insights from newly available consumer data.

utilities can develop strategies for moving consumers to more profitable profiles, where possible, or investigate ways to lower the cost of serving less profitable segments that are not likely to budge.

The insights from more sophisticated analytics also enable utilities to customize packages and programs based on fact-based analysis of consumer behavior, demographics and expressed interest. As utilities begin to offer a wider variety of programs and packages, it will be critically important to develop expertise in test marketing and running pilot projects. Fine-tuning such capabilities will help firms more accurately gauge consumer interest levels as well as spot larger trends that are just emerging.

Conclusion: Plugging in the involved consumer

Prominent environmental concerns, emergence of important new technologies, high energy prices... it seems we've been here before. So why is 2007 different than any other time in the history of the industry? These issues have come together at a time when a massive shift toward more active and independent consumer behavior is causing astonishing change in other industries. This combination of events is compelling residential and small industrial consumers to "plug in" to the energy business in a way never before seen.

The emergence of climate change as a global imperative has galvanized people to an extent seldom seen for issues that affect utilities. In our survey of 1,900 utility consumers in Europe, North America and Asia Pacific, 70 percent of consumers stated

that environmental impact is important in considerations of *what* they buy, and nearly three in four acknowledged that companies' reputation for having sound environmental practices influenced *from whom* they buy. With the indelible link between energy and climate in consumers' minds, it is clear that consumers no longer view energy consumption as simply an input to daily activities – it is viewed as having real outputs with longer-term impacts on health and quality of life.

Consumers have other concerns that perhaps affect them sooner and more directly than climate change, such as a decreased tolerance for power interruptions than in the past. While 68 percent of consumers stated that outages of more than two hours have a "high to severe" impact on their daily activities, almost 60 percent said that frequent voltage fluctuations had a similar impact. The combination of aging infrastructure and the need to improve overall efficiency (driven by both economics and the need to limit generation to reduce GHG emissions) will force utilities to make substantial near-term improvements.

These needs position advanced energy technologies such as smart metering, sensors and distributed generation to make inroads that have previously been difficult to achieve, even as the state of the art advanced. While the evolutionary path is not yet clear, we are convinced the long-term future of energy generation and delivery to residential and small commercial markets lies in participatory network structures. Within the next decade, we believe that the technological and regulatory building blocks to enable these structures will fall into place, and a significant and increas-

As consumer acquiescence gives way to active participation, utilities have significant opportunities to differentiate themselves and help redefine their industry.

ingly attractive segment of consumers will become actively engaged in managing their energy use.

The reason we believe that many consumers are building a strong desire to be more involved in energy decisions – with significant majorities of them considering pursuing energy efficiency, changing usage patterns to leverage time-of-use pricing schemes and even installing their own distributed generation units – is that they are becoming accustomed to a wider variety of choices in other traditionally “passive” services. In television, music, advertising and the like, consumers are no longer content to be positioned exclusively at the receiving end of content. They want to have more say in what options they have and how the companies that provide those services operate – and even in providing these services themselves. It is only natural, then, to see them extending this behavior into an area as fundamental as energy.

Often, when discussions of massive shifts in underlying industry bases and consumer behavior are forecast, “change or perish” pronouncements pile up. But we do not see things in that harsh a light – the future we see is much more positive for the vast majority of traditional industry players and a wide variety of new entrants. Yes, business models will evolve in untested ways, and consumers will begin to divide and subdivide into groups that reflect different needs and desires. But every company has activities that it does particularly well, and there will be customers who

want exactly those qualities and capabilities. The key actions to take now are to take stock in your areas of excellence, see where they best fit in the evolving industry landscape and determine what kind of consumers would be most interested in offerings that dovetail with those capabilities.

Certainly, this leaves much uncertainty for the next five to ten years. But what is certain is that surviving solely on the business of the acquiescent will become increasingly difficult. The industry’s future lies in a more participatory structure, where consumers that so choose can be actively engaged and information is abundant and free-flowing. To thrive in this environment, utilities must be prepared to harness realtime usage information, use it to decipher a much more complex consumer base and match products and services to each customer group. Those insights provide the foundation for serving customers – whether completely passive or boundlessly proactive.

To learn more about this study, please contact us at iibv@us.ibm.com. For a full catalog of our research, visit:

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