Consumer concerns about the environment, rising costs of energy, deprecating infrastructure components, and economic pressures are driving change in the utility industry. Utilities are responding by shifting into a dynamic mode of operation through the introduction of Advanced Metering Infrastructures (AMI). States and the federal government are supporting these moves in hopes the implementation of smart metering technology and energy management programs will meet the demand for energy without the need for new power plants.

**Smart Meters**

The key component of an AMI is the smart meter—a digital meter capable of recording and reporting usage data to providers and households. Smart meters with an appropriate user interface allow consumers to make informed decisions in response to real-time household power consumption data. In addition, smart meters can allow utilities to monitor and control systems in the home, provided those meters are equipped for that task. Most smart meters currently deployed outside trial programs provide utilities with consumption data but are not controlling systems in homes.

At the end of 2008, utilities had installed approximately 4.6 million residential smart meters. Collectively, utilities have announced plans to install more than 50 million smart meters for residential customers over the next 3-4 years.

- At the end of 2009, approximately 12% of U.S. households had an AMI-capable electric meter, rising to 20% in 2010.
- By 2015, utilities will have installed approximately 56 million meters on over 40% of all households.

However, few of the meters currently deployed are activated for use in two-way monitoring, communications, and control applications. Virtually all HAN-activated meters installed as of the end of 2010 are in test, trial, or pilot programs, and that likely will not change in the short term. The primary reasons for this include:

- Lack of a ratified ZigBee Smart Energy 2.0 profile
- Cautious approach among utilities—many utilities indicate they will be cautious with HAN deployments even after commercial products incorporating ZigBee SE 2.0 become available
- The need for PUC approval of rate structures that take advantage of smart grid capabilities—which could be a time-consuming process
- Time required to educate consumers about the benefits of HANs to stimulate their engagement and avoid any (further) backlash

These are all temporary inhibitors, but it means the market for solutions that work as part of independent (non-utility) residential energy management networks (iREM Nets) will grow more quickly than the HAN market over the next five years and remain dominant for the next ten years. By 2015, over 10 million U.S. households will have an iREM Net, and less than six million will have a utility-based home area network (HAN).
Drivers and Inhibitors Affecting Adoption of REM Solutions

**Consumers are not engaged in managing their electricity use**
- Many take typical steps to avoid waste, but few are aware of solutions that have the potential to cut costs conveniently and enhance their comfort.
- Parks Associates’ 4Q 2010 consumer survey revealed nearly 50% of U.S. households are still not at all familiar with the term “smart meter.”
- Utilities are well-positioned to build awareness, but initial deployments of smart meters in some regions spurred skepticism of smart grid capabilities nationally.
- Many consumers are not willing to allow utilities to control systems in their home even if they can override control.

**Utilities face multiple hurdles in AMI deployments**
- Economic recession is hindering utilities’ ability to make large AMI investments.
- Many of the new benefits require approval of new tariffs.
- Utilities seek to shed load; consumers seek savings.

**Opportunities for residential energy management systems are not confined to utility-based HANs**
- Consumers will adopt products and services that provide convenience, enhance comfort, and save money.
- PCTs, IHDs, and remote monitoring services are good examples of offerings that can provide value to consumers even if not part of a utility HAN or alternative billing program.
- Home controls are effective tools for consumers when they manage their participation in utility TOU and DR programs even if not part of a HAN.

**Multiple technology contenders for control standards hinder adoption**
- Chipsets which support multiple network protocols, both wired and wireless, will drive down the cost of supporting multiple network standards, thus pushing the industry over the standards hurdles.
- Collaboration among proponents of alternative standards will increase integration opportunities and choices for manufacturers, utilities, and consumers.

**Energy management business models remain a work-in-process**
- Consumers are willing to pay for systems and services to help them reduce expenditures on energy, but the amounts may not be not enough to create attractive business opportunities.
- Business models based on subsidizing equipment with recurring fees may be a viable option in a manner somewhat parallel to the models used for security systems and mobile phones.

**Drivers to the adoption of REM solutions**
- Consumer desire to reduce expenditures on energy
- Ready availability of solutions proven to be cost-effective
- Continued introduction of affordable products by manufacturers, service providers, and retailers that consumers know and respect
- Improved consumer education initiatives by utility companies as they continue to deploy advance metering infrastructures
- Emergence of remote home monitoring and control services that build on broadband Internet access
- Efforts by industry alliances and consortia in cooperation with major CE and home improvement retailers (once they commit to the REM category) to build consumer awareness for REM solutions
- Introduction of monitoring and control services by ISPs

Over the next 10-15 years, utilities will choose the technologies best suited to their needs and deploy them rapidly in their service regions.

For these reasons, Parks Associates has prepared an extended HAN forecast, beyond the standard five-year forecast horizon, which predicts that HANs and iREM Nets will match household deployments by mid 2020, with HANs then surpassing iREMs to approach almost 40% penetration by 2022. (See page 16 for more details on this forecast.)
Utilities are deploying 10-11 million smart meters each year across the U.S.

- Utilities had installed 13-14 million AMI-capable meters on U.S. residences at the end of 2009.
- By the end of 2015, approximately 56 million meters will be installed on over 40% of households.

However, few meters currently are enabled to communicate with in-home devices. Numerous trials are underway, but no full-scale HAN deployments exist. This situation will change in the latter part of the decade as trials conclude and utilities use these results to determine which technologies to deploy.

There will be a period of rapid HAN implementation from 2015 through 2020.

Utility-based home area networks (HANs) represent only one of several possible paths for residential energy management solutions and services to enter the consumer market. Consumer demand for energy-saving solutions will attract new sets of players, including communications service providers and technology vendors. Even security monitoring service provider ADT has entered this market.

The ability to remotely monitor a home and control systems such as thermostats and door locks is attractive to many consumers. Broadband service providers see these capabilities as logical extensions of their offerings.

Other examples of utility-independent solutions include simple handheld energy monitors that communicate via a sensor attached to an electromechanical meter. More advanced products offer capabilities such as Wi-Fi-enabled thermostats capable of two-way communications for Web-based remote monitoring services.

Integrated REM solutions—adding energy monitoring and control capabilities with existing home control applications increases the attractiveness of products and expands the target market.
Leading technology firms are developing solutions in this area:

- **ADT**—The company introduced the ADT Pulse whole-home automation solution in October 2010. System includes home security, energy management, and home control components.

- **GE**—GE is doing numerous things in the REM and smart grid space. The company will launch the GE Nucleus later this year, which is a wall-outlet Internet gateway that communicates with a smart meter and transmits energy consumption data to the cloud.

- **Cisco**—The company’s Home Energy Controller (HEC) is being employed as part of Duke Energy’s smart metering pilot in the Carolinas. The HEC is an energy monitoring and management display supported with a full web interface that offers cloud-based services and provides weather, traffic, and other data.

- **LG**—LG is developing smart appliances, including washers and dryers.

- Other innovative solutions include cloud-based services and mobile applications.
Remote home monitoring services are emerging applications sparked by the availability of broadband and demand for content access from the cloud.

Consumers can connect a variety of sensors (motion, door/window, power, water, etc.) and a camera to an Internet connection that then feed information to a website. Users can receive notifications on a mobile phone or by email should a change in status or an alert occur or check for updates via any web-connected device.

An early player in this area is iControl, which now collaborates with ADT Security to allow ADT customers to access their home status or receive alerts across multiple platforms. It is a value-added feature to professional security monitoring made affordable by the pre-existing diffusion of broadband capabilities within many homes currently paying for professional monitoring.

Another early participant is Alarm.com, which sells its service through independent security dealers. The company originally provided control capability using X10 technology but has now switched to Z-Wave. As is the case with the ADT offering, Alarm.com dealers offer the self-monitoring and control capabilities as additive features to professional monitoring services.

Companies can build off remote monitoring to offer remote control solutions for other systems, including HVAC, lighting, security, and door locks.

Video and telephone service providers are actively exploring remote home monitoring services as opportunities to expand service bundles and build customer loyalty, with communication service providers such as AT&T, Qwest, and SureWest already offering services.

The adoption of remote monitoring systems and services will occur gradually and only after consumers become aware of these capabilities. Conditions that may accelerate adoption include offerings from major service providers that couple remote home control and monitoring services with Internet, voice communications, and content services. This bundling strategy, combined with the marketing might of these large players, could easily ignite consumer demand.

Parks Associates’ surveys show over 30% of U.S. broadband households are interested in the ability to remotely control appliances and thermostats and monitor security cameras through a PC or mobile device. U.S. respondents rate their interest in the ability to remotely monitor their homes via IP or web cameras the highest of any provided remote application. Remote monitoring and control of thermostats was next, followed by remote lighting control.

Other applications within the category of remote monitoring systems and services include activity monitoring of elderly family members, “latchkey” children, and pets as well as power outage and severe weather notifications.
By 2015, 11% of all households will have remote monitoring and control systems installed.

These systems enable consumers to control systems in the home such as HVAC, lighting, security, and door locks remotely.

Rollouts of monitoring services by security and communications providers will grow this market, and as a result, most consumers with remote monitoring capabilities will not subscribe to separate, fee-based services, especially in the early stages. Many will have access to these capabilities as part of existing subscriptions to professionally monitored services or broadband subscriptions.

As the capabilities of fee-based services increase, expanding beyond standard remote monitoring solutions, these offerings will attract more consumers. By 2015, five million households will subscribe to fee-based, self-monitoring services, accounting for 35% of all households with remote monitoring capability. Applications include remote monitoring and control to manage energy-consuming systems. Parks Associates’ consumer research indicates 15-20% of U.S. broadband households are very likely to pay for an energy monitoring service at a cost of $5-$10 per month. This group of households represents the early-adopter market from energy-related remote monitoring.
The residential energy management market is not limited to smart meter deployments and HAN activations.

Parks Associates forecasts that consumers will adopt systems that display and allow them to better manage their electricity consumption. Some of these systems will be connected to data and/or control networks in homes, and others will operate on a stand-alone basis.

Detailed forecasts for selected systems that can operate in either a HAN or independent residential energy management network (iREM Net) are in Parks Associates’ report *Residential Energy Management: Forecasts for AMI Deployments and Energy Management Solutions*, published in June 2010.

A basic iREM Net includes a programmable communicating thermostat. More capable iREM Nets include load control modules (LCMs) for water heaters and/or pool pumps and integrated controls for other energy-consuming systems. A control system dedicated to security or lighting is not considered an iREM Net in this analysis.

Parks Associates forecasts that more than 10 million U.S. households (8% of U.S. households) will have some form of iREM Net by the end of 2015. Another 4.7%, or 5.9 million, will have a HAN.

If a household has a HAN, it is unlikely to also have an iREM Net. Consequently, the two solutions are considered to be mutually exclusive. Clearly, there is a significant opportunity, especially in the early stages of the market, for companies to provide products and services that enable iREM Nets.

![Graph showing U.S. Households with HANs vs. iREM Nets (2010 to 2022)](image-url)

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Utilities have the motivation, capability, and, for the most part, trust of consumers to provide viable energy-saving solutions. Parks Associates’ research indicates that consumers trust their electric utilities regarding information and solutions for energy conservation and cost savings. To be able to monetize this trust, utilities must find ways to micromanage demand in order to fully utilize their generation capabilities and operate their distribution networks more efficiently. Therefore, utilities will activate smart meters with HAN capabilities once they complete their trials and determine which technological approaches are most likely to achieve their goals.

This activation will take time. As a result, iREM Nets will be more prevalent than HANs at the end of 2015; however, there will be a period of rapid implementation of HANs from 2015 through 2020 and beyond. By 2020-2021, the percentage of households with HANs will equal that of households with iREM Nets. As a result of HAN implementation, growth of iREM Nets will decline, and the percentage of households having them will level off…and then decline in the 2020s.

The implications are clear for firms targeting opportunities in residential energy management. Ultimately, opportunities for solutions within utility-driven market environments will be dominant, but over the next 8-9 years (2011 to 2020), opportunities in iREM Nets will be most prevalent. Therefore, firms seeking to be major providers of REM solutions must develop parallel go-to-market strategies to succeed in the long term: one that addresses the near-term opportunities for iREM Nets and another focused on working closely with utilities. Parks Associates’ forecasts function as a “market clock” which companies can use to time their shifts in priorities and resource allocations.

The Question Remains: “How will Utilities Engage Consumers in Energy Management Solutions?”
Opportunities Beyond the HAN

by Farhan Abid, Research Analyst, Parks Associates

Residential energy management and the smart grid market will serve as catalysts for the adoption of many new energy technologies.

Frequently, and for good reason, discussions about this emerging market focus on the expansion of smart grids as these solutions enable electricity distribution systems to manage alternative energy sources (e.g., solar and wind), improve reliability, facilitate faster response rates to outages, and manage peak-load demands. The deployment of REM technologies creates opportunities that include smart appliances, electric vehicles, and microgeneration, among other things.

There are numerous local, state, and federal incentives supporting the development, installation, and implementation of microgeneration technologies, targeting both consumers and enterprises, in order to save money and encourage conservation.

- A federal tax credit of 30% of cost is available for existing homes and new constructions to install geothermal heat pumps, small wind turbines, or solar energy systems.
- A federal tax credit of 30% of cost, up to $1,500, is available for homes to upgrade to energy-efficient HVAC systems, insulation, water heaters, and windows and doors.
- Corporate Renewable Energy Grants of 30% of property value are available through the U.S. stimulus fund for businesses installing solar, geothermal, or wind turbines.

New Markets

The advent of alternative energy will change the role of the individual from a simple consumer to a power generator; households will have the ability to sell power back to the utility. The main opportunities will take one of three forms—smart appliances, electric vehicles, and microgeneration.

Smart Appliances

Appliances typically account for only 13% of electricity consumption (EPA 2010). Appliance manufacturers are developing Smart Appliances that can be controlled by the electric utility to temporarily reduce power or delay some normal operations during peak pricing periods. The owner can override the utility’s actions if desired. Some examples of how these appliances will operate during peak times:

- A refrigerator delays its defrost cycle—a cycle that takes more energy than normal operating mode—until the energy cost is lower.
- A dryer reduces the wattage used by the heating coils.
- A dishwasher delays its start until a time of day when electricity rates are lower.

• CE manufacturers developing Smart Appliances include GE, LG, Panasonic, and Whirlpool. All major appliance manufacturers have announced the launch, production, or development of smart, connected appliances.
• The primary focus of manufacturers is to support utility DR programs.

Challenges

- Additional incentives are necessary to drive market acceptance.
- Utility subsidies and tax incentives will be required.
- Smart appliances should be viewed as one component of energy-efficient homes, not as stand-alone product opportunities.
Electric Vehicles

- Growing popularity in recent years driven by:
  - Rising cost of gasoline
  - Environmental concerns
  - Improvement in battery storage technology
  - Government support through tax credits
- The Obama Administration has a goal of supporting the deployment of 1 million plug-in electric vehicles by 2015.

Driving ranges vary depending on how people drive and other factors, such as the weather and use of heater or air conditioner.

Challenges

- High Price—the average cost for an electric vehicle is over $30,000.
- Batteries are developed by third parties.
- Charging stations must be made widely available.
- Utilities must develop means to handle additional load on power grid.
- Billing mechanisms to handle roaming charges must be developed.

Microgeneration

Microgeneration, or local energy generation, is the ability to generate power and electricity on a small scale through renewable sources of energy such as solar, wind, and geothermal. Microgeneration can support the functioning of small islands, army bases, neighborhoods, individual homes, schools, and small business buildings independent of the power grid.

Types of Microgeneration

- Wind Turbines
  - Electricity generated by converting wind power through the use of turbines
- Geothermal Energy
  - Extracting heat present in the ground and converting it into electricity
- Solar Energy Systems
  - Capturing light energy from the sun with the help of solar cells embedded in photovoltaic panels (PVs) and converting it into electricity

Microgeneration

- Strong Interest
  - There is strong interest among consumers and enterprises to learn more about alternative energy.
  - Consumers and businesses alike want to find out how they can support and benefit from microgeneration industries.
- Utilities Need Backup
  - The growing demand for energy and the cost of developing more power plants are motivating some utilities to consider microgeneration as a backup to tackle load shedding and power outages.
- New Markets
  - The advent of alternative energy will change the role of the individual from a simple consumer to a power generator; households will have the ability to sell power back to the utility.

Challenges

- Ability to Integrate with the Electricity Grid
  - Many technological and regulatory challenges exist in integrating microgrids with the larger power grid.
- High Cost
  - Even with financial incentives, the technology is expensive to develop and implement, and the rate of return for PVs and other renewable technologies is not clear.
The Consumer Mindset

by Farhan Abid, Research Analyst, Parks Associates

Engaging consumers is critical to the success of all participants in the REM market—including utilities, communication service providers, CE and appliance manufacturers, and suppliers of in-home networking gear and control systems.

Understanding consumer attitudes, opinions, needs, and motivations is the initial step in understanding the demand and drivers for various residential energy management (REM) systems and services.

A primary question addressed in Parks Associates’ REM research is…

“How motivated are consumers to manage their electricity consumption?”

If they are uninterested, then there will be limited opportunities for many of the systems and services being introduced into the market. On the other hand, if they are interested in cutting energy costs (and Parks Associates’ Residential Energy Management research shows that they are), we need to determine what motivates them and whether they are willing to pay money to achieve their goals.

Key segmentation parameters include household energy expenditures, CE ownership, current service contracts, and attitudes about energy savings and utility control of their appliances.

The vast majority of consumers are very interested in reducing expenditures on energy consumption, and they are willing to pay to save.

The problem is, on average, consumers are not willing to pay enough to cover the cost of required systems. Consumers are willing to pay $80 to $100 on a one-time basis for a system that will save 10-30% on their electricity bill. Therefore, innovative business models must be developed to capitalize profitably on the opportunities. Companies must address the following questions in developing successful business strategies.

What factors affect interest and willingness to pay to reduce electricity costs?

Over one-half of all U.S. broadband households report their electricity rates have increased more than 10% from 1Q 2009 through 1Q 2010. These market conditions have generated a general interest in energy-saving solutions. That does not necessarily translate into willingness to pay for REM solutions, but in combination with a renewed cultural emphasis on energy conservation, it does create an overall base of interest.
Are there specific groups of consumers to target in the early stages of REM market development?

- Consumers who are environmentally conscious (37% of U.S. broadband households)
- Consumers reporting a willingness to allow utilities to control systems in their home (35% of U.S. broadband households)
- Consumers who subscribe to professionally monitored security services (14% of U.S. broadband households)
- Consumers who are actively engaged in managing their energy consumption. For example, 3% of U.S. broadband households place a timer on their water heater, and 58% set back their thermostats to limit their energy usage. Both groups would be excellent prospects to adopt REM solutions.
- Young consumers (18-34), which represent 24% of U.S. broadband households.

Who do consumers trust to help them manage their energy consumption?

Consumers look to electric utilities for energy monitoring and savings solutions FIRST, but other service providers are strong contenders to gain the trust of consumers if they choose to offer energy management services. Consumer levels of trust in cable, telco, and security service providers are relatively equal when considering an energy monitoring service. Having that established relationship with a provider (including a billing relationship and some level of in-home infrastructure) is significant, as Google-type companies (i.e., over-the-top providers) do not score as well among consumers for REM-oriented services.

**Trusted Providers for an Energy Monitoring Service**

(Among U.S. Broadband Households)

- **Electric Utility** 83%
- **Air-conditioning and Heating Service Company** 49%
- **Cable Company Provider** 43%
- **Telco Service Provider** 36%
- **Security Service Provider** 35%
- **A Google-type Company** 27%
- **Other** 26%

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