

Invensys Home Controls – Home Manager™ Residential Load Management Service Offering

Background

Traditionally, utilities have done an excellent job of providing a reliable source of power to their customers. Utilities do this by accurately predicting consumer demand and then ensuring that they have adequate generation resources available to meet that demand. Historically, demand for power increases each year during peak heating and cooling months, resulting in a need for ever increasing amounts of generation capacity. A review of the peak period demand clearly show that we could eliminate the need for a substantial amount of new generation assets if there was a way to shift some of the demand from peak to off peak times.

Current Programs

Utilities do currently offer demand reduction programs to their customers. These programs are designed to shift loads out of peak periods by providing a financial incentive for consumers to move loads to a time when it is less expensive for the utility to produce or obtain power. **Time of day** rate is an example of such a program.

Another type of program offered by utilities is the traditional Demand Side Management (**DSM**) program. This type of program provides the customer a monthly credit for allowing the utility to interrupt power to major loads in their home during peaks or emergencies.

While both of these programs have been shown to work, they each have their problems. Time of day rate programs are difficult for customers to understand. Therefore these programs have a very low participation rate among the customer base. **DSM** programs, on the other hand, have a much higher participation rate. However, **DSM** load sheds are seldom exercised by the utility. And, when the utility does exercise a load shed, the resulting interruption of power tends to affect customer comfort, thereby causing large numbers of customers to drop out of the program. In addition, current DSM programs cannot differentiate between those consumers that contribute to a load control, and those that don't, while providing incentive credits to all who sign up.

While both **time of day** rates and **DSM** programs can be effective, each have challenges in the area of customer satisfaction that erode their usefulness. In addition, utilities earn little revenue from these types of offerings and therefore look to new generation as a more economically viable option.

GoodWatts™

To solve this dilemma, Invensys Home Control Systems has developed the Home Manager™ coupled with the GoodWatts™ Service offering. The Home Manager is an “always on” home control system that monitors and manages major residential loads. It is designed to reduce the peak demands of the home while maintaining acceptable customer comfort levels. The Home Manager is the next generation of residential load management.

How does it work?

In each home, the Home Manager operates over a wireless network with a residential gateway communicating with the major loads in the home. The gateway is attached to a broadband network that connects each home to the distribution utility or energy service provider serving the home. This network creates a direct link between the energy supplier and all the major loads in the home.

Unlike traditional systems, the in-home network supports a wide array of monitoring and control points including:

- Whole house interval metering
- HVAC thermostat monitoring and control
- Sub-metering and control of other major loads (such as pumps and electric water heaters)
- Net metering for effective management of distributed generation assets

Today, the system is designed to provide monitoring and control of these major loads with the potential to expand to other points of control in the future, thus expanding its sphere of control and home automation capabilities. Future features like home security and appliance monitoring are all part of the product road map for the Home Manager system.

System Features

The unique design of the Home Manager system give it operational characteristics unlike any other system on the market today.

Customer Comfort Preserved

The Home Manager ensures optimal customer comfort by providing soft load control of HVAC systems. This precise control allows the heating and cooling systems to operate more efficiently without impacting customer comfort levels. This level of control is enabled by the unique temperature ramping capabilities of the Variable Deadband Thermostat. This thermostat manages the environmental comfort range in the home by

varying the set point over a range of settings in tenths of a degree. Because of this precise control the system is able to deliver energy reductions using a soft load control eliminating the thermal gain or loss characteristics of traditional control systems which result in customer complaints.

Revenue Neutral

GoodWatts controls other major loads in such a way that the energy provider does not lose revenue, and the customer's needs are also met. For instance, while the customer may specifically program a major load, such as a pool pump to run a set number of hours, he is generally indifferent to the exact time that the pump runs. In GoodWatts, items like pool pumps are reprogrammed to run for the same number of hours desired by the consumer, however, the load will not operate during peak periods. The net result is that the energy provider does not have a loss of energy sales, and the consumer does not have a loss of functionality. Therefore, GoodWatts allows utilities to shift loads without the loss of total energy consumed and its associated revenue.

Enhanced load profile data allows for equitable distribution of incentive payments to consumer.

Another unique feature of the Home Manager is its ability to provide ANSI C12 revenue grade sub metering at the load control level. Home Manager provides individual load profiling as well as a means to verify the exact load reduction contributed by each load to a specific curtailment command. Through this feature of load measurement and verification, utilities are able to implement a more equitable system offering a payment based on the actual contribution by the homeowner, rather than a traditional offering that provided customers with a flat credit incentive and allowed "free riders".

Data Aggregation

The Home Manager's "always on" broadband network connection to the utility opens the door for much higher levels of monitoring and management of residential loads. The 'always on' connectivity allows the utility to know exactly how much load is available from each participating end use device in a home and allows the utility to aggregate that load up to a circuit, sub station or any other combined total they desire. They can target specific loads or geographic areas and manage demand more closely by getting verification of each control request as the curtailment commands are initiated. The utility can then pass detailed load curtailment data on to the back-office billing programs at the utility where credits can be applied to customer bills commensurate with their contributions.

Future Enhancements

Another potential future use of the system is its ability to monitor and control remote generating capacity such as photovoltaic systems at customer locations. Just as the system can monitor and verify load control reductions, it is equally capable of monitoring, dispatching and verifying remote generation capacity. All of the Home Managers ANSI C12 meters are net meters capable of detecting and reporting power flow in either direction making our load control relay modules ideal for such applications.

Who is the system for?

Under this offering, ideal targeted customers (those with a load reduction capacity of 1.8kw or greater during peak periods) would be working families whose homes are normally unoccupied on workdays during the majority of peak hours. However, homes that remain occupied during the day can also easily become candidates for the program.

In summary, homes participating in the program permit their controlled loads to be shifted through regularly scheduled control programs. These loads operate normally during off peak hours but would be restricted during peak times. Thermostat setbacks are performed using a utility specified ramping rate, pumps are programmed to operate around peak hours. Water heaters and other major loads receive similar load shifting instructions. Using the revenue grade interval metering capabilities of the system, the utility is able to compute the actual load reduction capacity of each load in the home based on a rolling baseline average and subsequently credit the customer for capacity contributed daily.

A new way to look at Load Control

By combining the unique features of the Home Manager with a paradigm shift in thinking, utilities can offer programs to their residential customer base that treats the system as a distributed renewable generation resource capable of earning above average allowed rates of return. Public Service Commission officials have received this concept positively.

By treating aggregated loads as micro generation facilities, the utility will now have the ability to earn on the 'capacity' offered by the GoodWatts control system, as a conservation rate based asset. It is also possible for the utility to recover the average fuel charge for a peaking unit, through a traditional fuel recovery clause, to cover the costs incurred in operating the GoodWatts system in lieu of actual fuel costs for the capacity delivered. This recovery vehicle creates a reserve fund from which the utility will pay the system operator and make incentive payments to the customers who participate in the program.

By its nature, the generating 'capacity' produced by the GoodWatts distributed generating system is a renewable resource, as it does not consume fuel to deliver the energy component. This feature may qualify the system for special rate treatment by the Public Service Commission depending on the State in which it is deployed. In addition, GoodWatts can help the utility satisfy the proposed federal requirements stipulating that utilities should offer a mix of 10% renewable capacity by 2020.

Summary

In summary, the Invensys Home Manager is a next generation load management and dispatch control system capable of generating new revenue sources for utilities and energy service providers. Its measurement, verification and reporting capabilities place it in a unique position of helping energy providers meet new State and Federal energy legislative demands while opening up new sources of revenue in an area traditionally viewed as a revenue reducer.

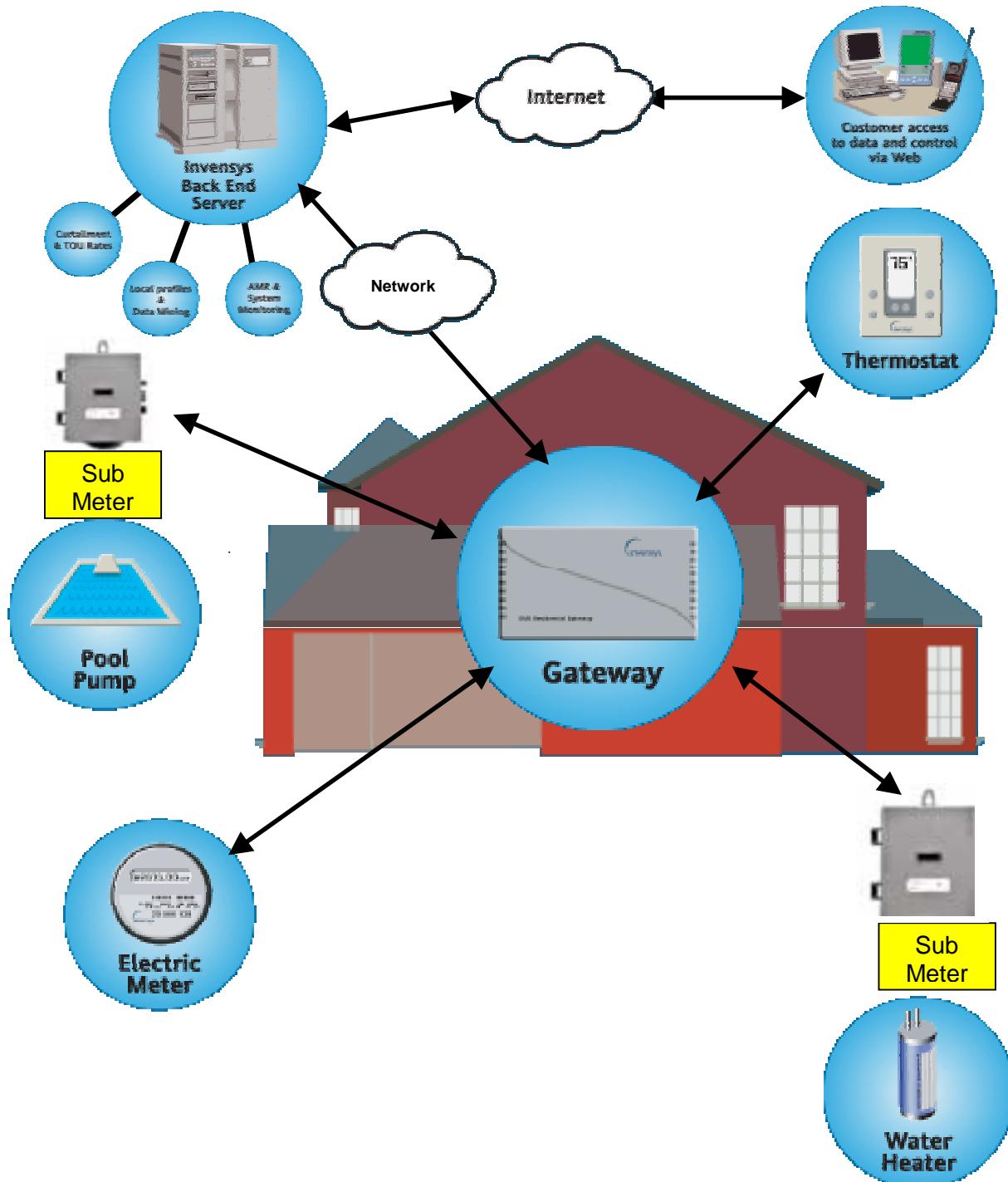
If this program is of interest to you and your company and you would like to learn more about it and the business model that supports it, please call Dru Mears at Invensys Home Controls in Richmond, VA, USA 804.289.4480. Dru will schedule an appointment for a confidential assessment of your needs that will help you determine how the Home Manager can assist you in meeting your goals and objectives.

GoodWatts™ Program Summary

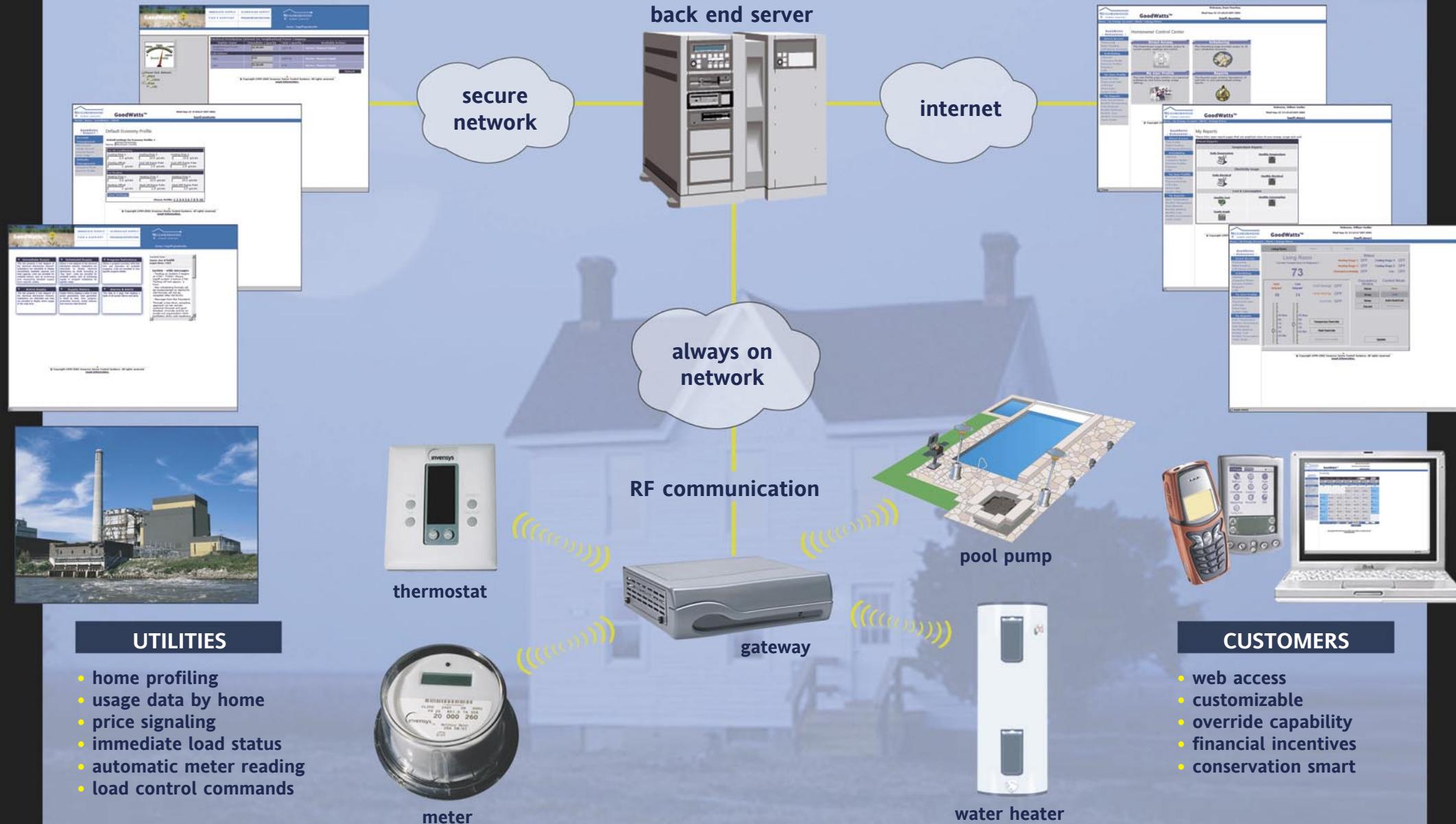
- ✓ GoodWatts is a program that automatically shifts discretionary residential loads out of peak demand periods and credits customers who participate with KWH rebates based on their actual (measured & verified) contributions.
- ✓ The program delivers the same results Time Of Day rates were designed to deliver without a variable KWH cost component. Rebates for shifting demand, provide the consumer incentive versus higher rates in on peak periods.
- ✓ Unlike traditional DSM programs, GoodWatts performs soft load control (control of comfort levels) on HVAC systems by modifying thermostat set points, use of temperature ramping and restricting the use of heat strips and secondary stages of compressors. These are exclusive features of the GoodWatts system thermostat manufactured by Invensys.
- ✓ GoodWatts is designed to operate like a power plant, in that it would be dispatched every working day to shift peak loads but would not operate on weekends or holidays (similar to current residential TOD Tariffs).
- ✓ The capital investment for a GoodWatts plant is 90% of a comparable peaking unit and far less than that of a base load facility.
- ✓ The book life of a GoodWatts plant is 20 years with technology refreshing built in, to extend its life beyond the 20-year horizon.
- ✓ GoodWatts was designed to compliment new and existing generating plants, providing an alternative to peak demand generation, with similar economic benefits.
- ✓ GoodWatts uses no fuel, does not require siting approval and is environmentally benign as such it can qualify as a renewable energy source.
- ✓ If GoodWatts is used to displace existing DSM programs, which offer fixed rebates, it will only credit customers for their contributions and in many cases will have no impact on residential rates. In addition, it will deliver full benefits; eliminate "free riders" and more equitably reward customers for actual contributions.
- ✓ GoodWatts is a load-shifting program and therefore has little impact on overall total KWH usage. While some loss will occur as a result of load shifting, studies have shown that increased usage outside of peak periods often offsets or increased total KWH consumption per home.
- ✓ GoodWatts initially will target HVAC, water heating and pumps to shift demand. It has been designed to extend its control to cover other loads in the home giving the customer an incentive to upgrade to newer "smart appliances". Invensys, is the largest supplier of controls to appliance manufacturers in the US and is working with its customers in the appliance industry to make this a reality.

- ✓ GoodWatts is a platform technology designed to be a vehicle that enables the sponsoring energy provider to enjoy profitable revenues lines from the new services it facilitates.
- ✓ GoodWatts technology can be used inside an energy provider's service territory or outside as part of an outsourced capacity asset project.

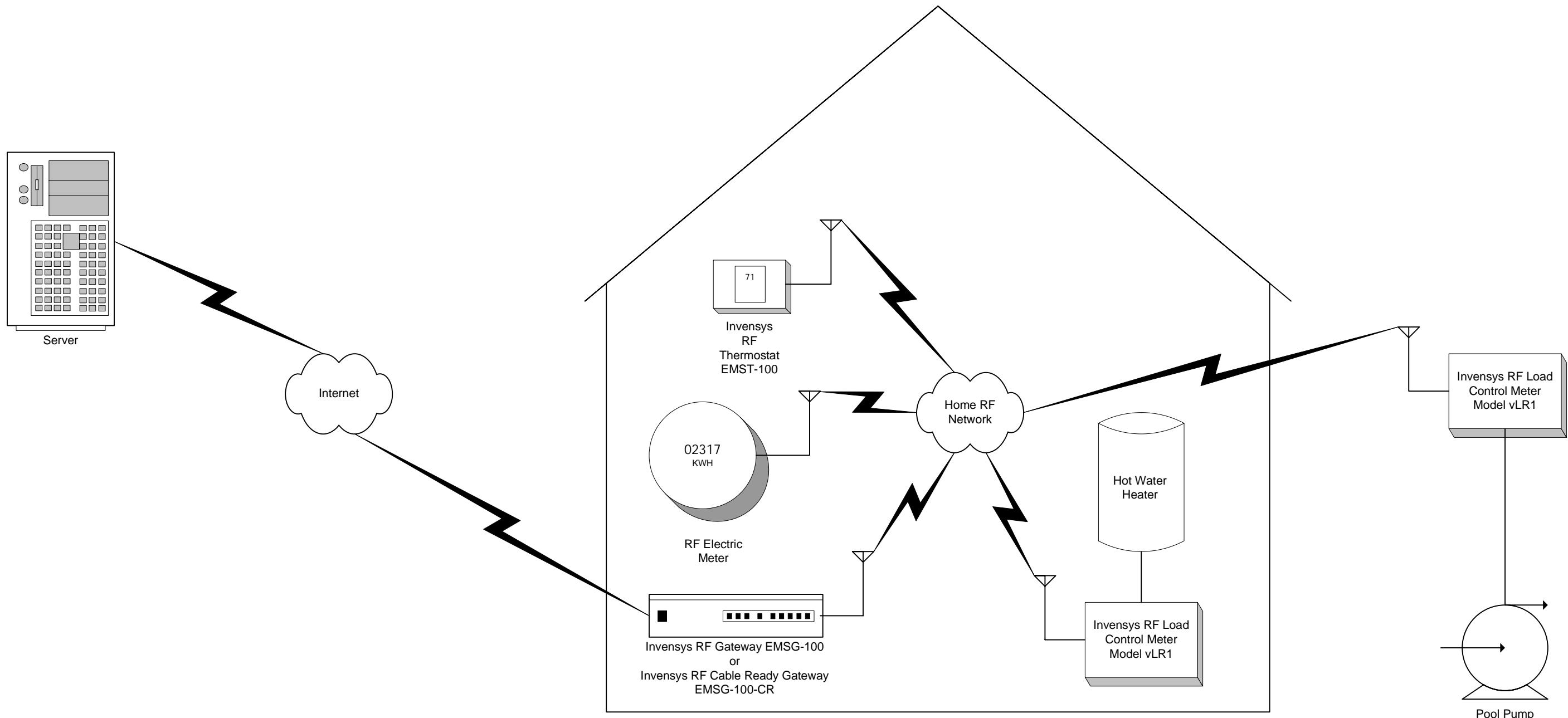
Pictorial representation of the system architecture.



ENERGY MANAGEMENT SYSTEM



The GoodWatts System



Invensys Home Manager™

Introducing... Energy Management Services



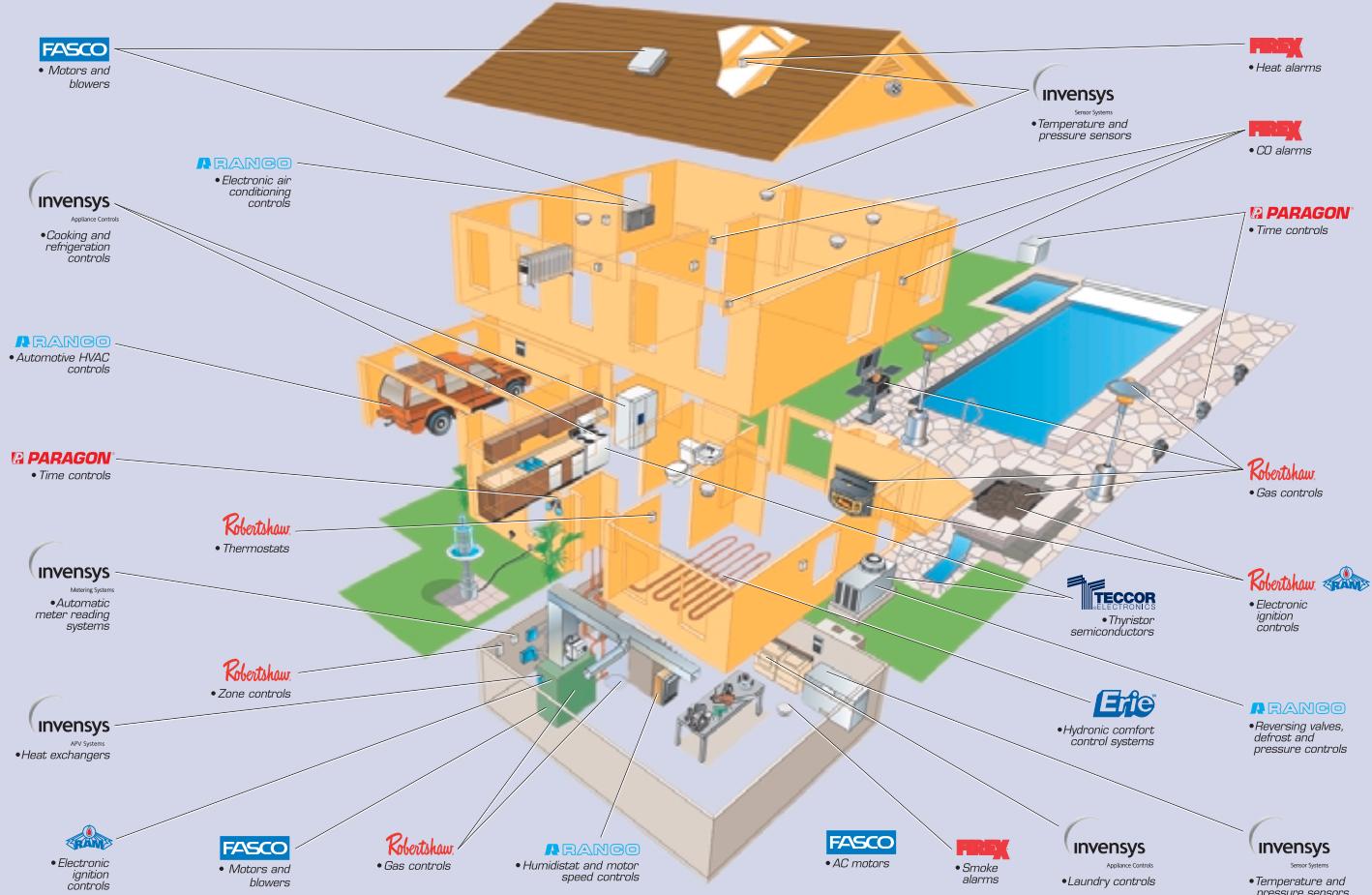
Invensys, a leader in the **Controls & Automation** industries with more potential in-home control points than any other company... is leading the way in home energy management.

Invensys components are already in your home performing critical functions behind the scenes.

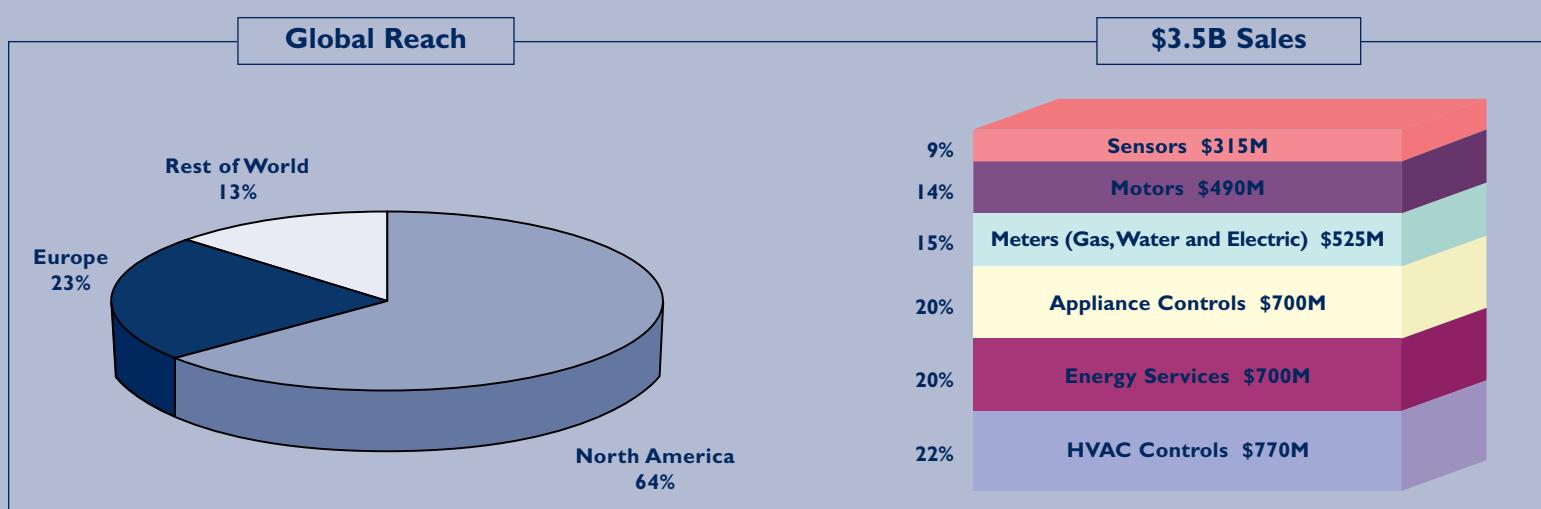
These include:

- Thermostats
- Electric meters
- Gas meters
- Water meters
- Smoke, Heat and CO detectors
- Motors
- HVAC Controls
- Appliance Controls
- Hot Water Heater Controls
- Pool Pump Controls
- Hot Tub Controls
- Lighting Controls

Invensys has invested millions of dollars towards research and development in order to make its controls network-addressable. Now, Invensys can use these points of control, to create services for the home - services that can be offered to your customers.



Invensys serves global markets offering HVAC controls, Appliance Controls as well as Motor and Sensors for a wide variety of applications. Invensys is also a global leader in utility metering and AMR solutions, an established presence in energy information services, including data collection, aggregation, estimation and validation.



Invensys is offering a new residential service called the Home Manager Energy Management System ("EMS"). EMS gives utilities a cost effective way to implement Price Responsive Load Control, manage demand and obtain vital usage data, while giving their customers a tool to easily control their energy consumption. Unlike current load control systems that are either on or off and provide no feedback to the utility as to the effectiveness of the control action, EMS allows the utility to adjust load by varying the temperature of the residence by a few degrees, and then provides the immediate feedback that the action is indeed reducing load.

Always On

EMS uses an 'always on' connection, (via cable, DSL or satellite network) to provide two-way communications between the utility, the home, the Invensys Back End Server and your customer...who can monitor and control their home energy usage via the internet from virtually anywhere.

Smart Control

Smart, communicating devices make up the backbone of the EMS System. A Home Control Gateway communicates via radio frequency (RF) to controls within the home, to the home PC via wired or wireless Ethernet, and to the Invensys Back End Server over the Always On Network.

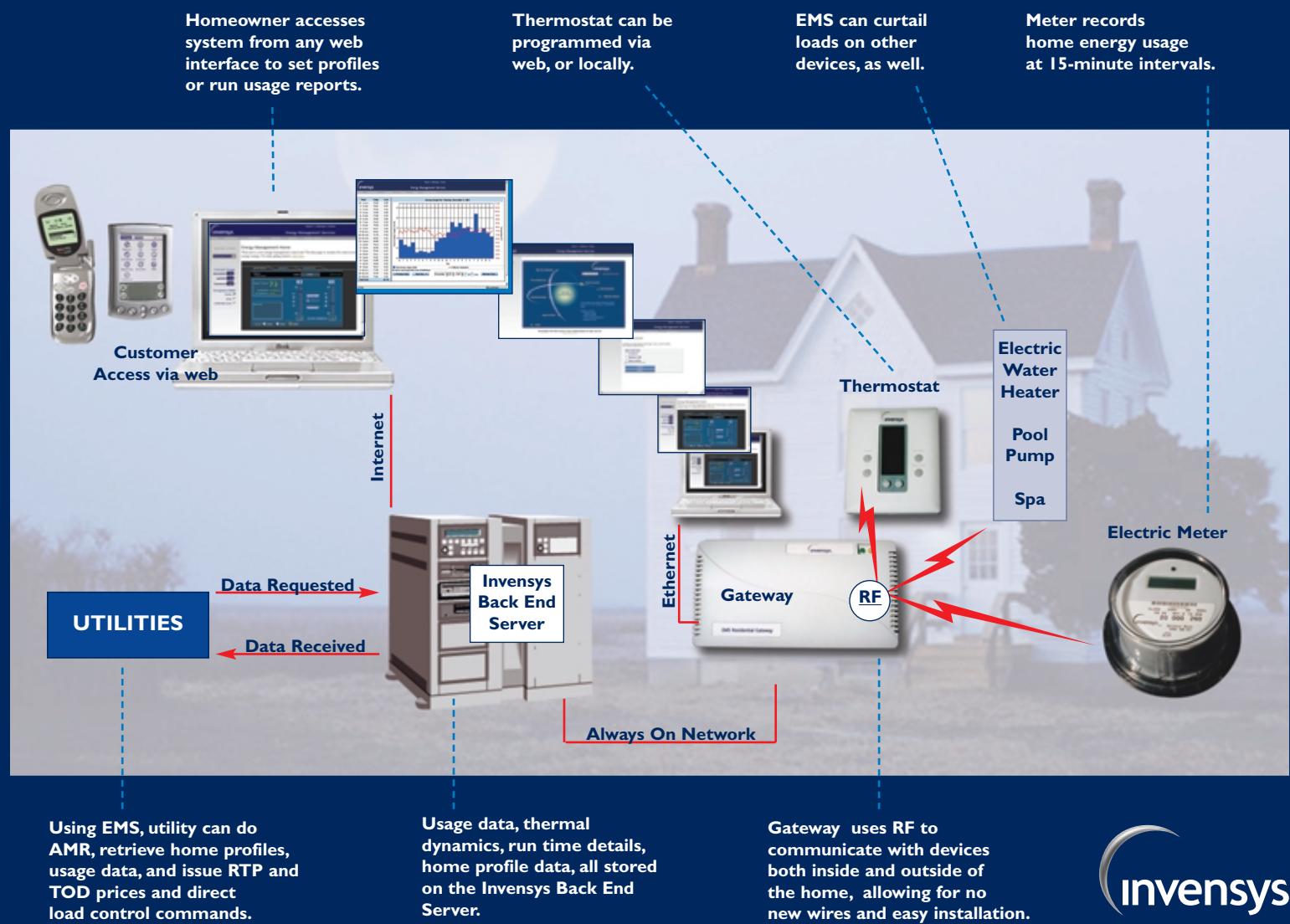
Command and Control

EMS expands the reach of the SCADA and Demand Side Management systems of your utility, enabling traditional and advanced Demand Response Programs. The system supports real-time load aggregation; real time, time of day, hour ahead, and day ahead energy pricing; economic and emergency load curtailment; demand bidding; and direct load control by the utility and the customer. The system can help the utility manage peak loads, transmission constraints, price spikes and environmental compliance programs.

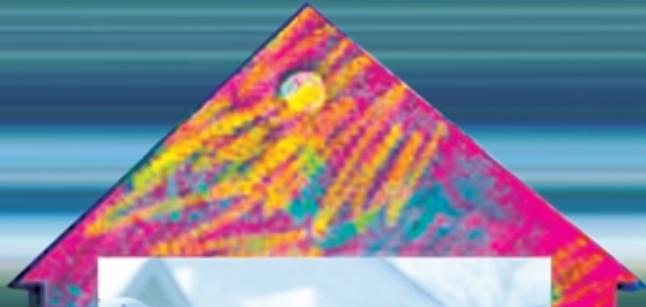
Easy Access, Anytime, Any Place

Your customer can access the system while at home or away. Via any web interface the customer can set up a daily, weekly or monthly profile of how the temperature in their home should be maintained. They can also schedule other major load to operate in response to price signals from the utility. Since historical setting of customer price/comfort points, customer preferences, and home temperature readings are maintained on the Invensys Back End Server, the utility has the ability to generate load profiles and energy efficiency estimates on a residence by residence basis.

Energy Management System



Key Benefits for both the Utility and the Consumer



**EMS offers the utility...
improvements in Demand
Side Management, Operational
Efficiency and Customer Service:**

Demand Side Management

- Feature rich, cost-effective solution
- Reduces peak demand
- Enables management of spot power purchases
- Assists in environmental compliance
- Price responsive load management
- By premise load profile
- Detailed/aggregated load response statistics

Operational Efficiency

- Improves economic dispatch and congestion management
- Extends SCADA control to the home
- Extends SCADA beyond service territory.
- Supports advanced metering
- Improves system monitoring and reliability

Customer Service / Retention

- Unique service creates added value for customer
- Potential channel for future home services

Cost Effective

- Lowest cost, highest performance system available for customer
- Should qualify for conservation recovery and environmental compliance
- Potential tax incentives in federal energy legislation
- Generates cost effective 'Negawatts' avoiding the need for new generation

**EMS offers the Consumer...
Comfort, Convenience,
Control at low or no cost:**

Comfort

- Soft HVAC control
- Zonal flexibility
- Occupancy sensitive
- Weather normalized
- Learns customer preferences

Convenience

- Set it & forget it
- Intuitive user interface
- Web enabled access
- System automatically adjusts to market dynamics

Control

- Full override capability
- Financial-based energy management
- Individually customizable
- Platform for other value added services
- Remotely manageable
- Balances saving and comfort

Cost / Savings

- Low/no startup cost
- Low/no monthly cost
- Credits scaled to peak load reductions (no free riders)
- Potential tax credits
- Fixed & low income program support
- Energy efficiency & conservation help tools
- Level billing program support
- Maximizes energy usage efficiency
- Energy Star savings candidate
- Supports pre-paid utility model