Consumer Portal Stakeholder FAQ and Survey

This document is intended to provide a concise summary of current views on what a consumer portal *could* be and to elicit views from a variety of sources about what it *should* be.

The first part of this document is a list of Frequently Asked Questions (FAQ) with answers as they are understood currently. The second part is your chance to influence the answers.

What is a Consumer Portal?

One formal definition of a consumer portal is *"a combination of hardware and software that enables two-way communication between energy service organizations and equipment within the consumers' premises."* Figure 1 illustrates this idea.

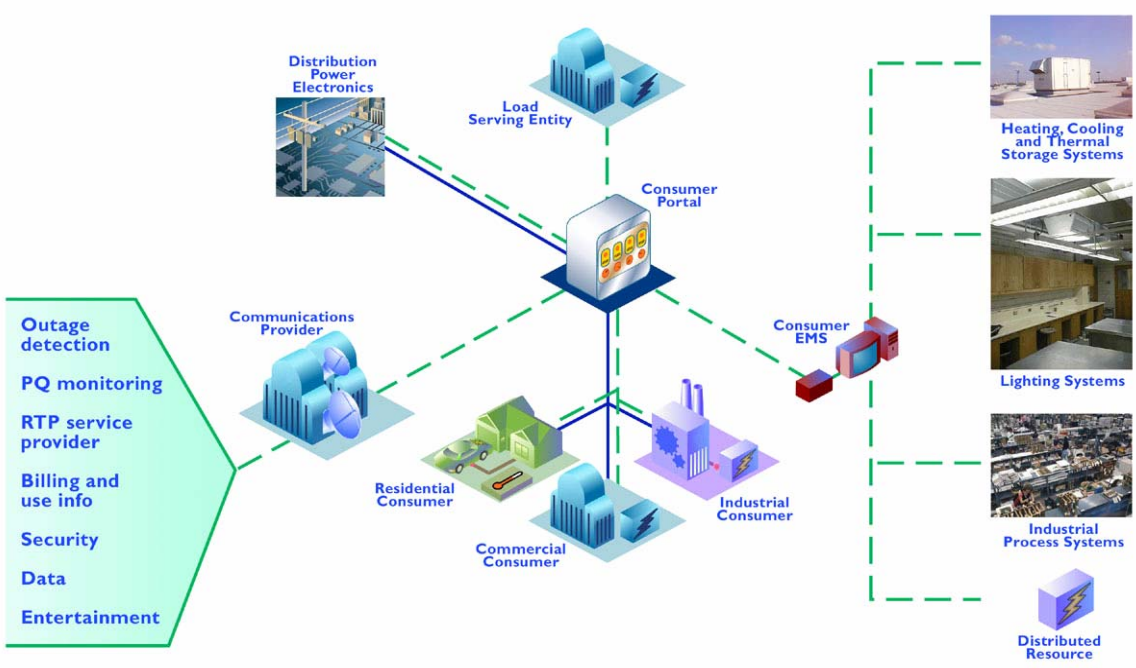

Figure 1 The Consumer Portal Concept

At a technical level, a portal provides a physical and logical link between wide area networks and consumers' in-building networks. It may be a "router" that simply forwards messages, or a "gateway" that translates between technologies.

A portal can be thought of as a "virtual device": a set of applications and interfaces that may be located within a meter, a thermostat, a PC, a set-top box, a stand-alone device, or distributed among devices or appliances at a customer site. These applications would participate in large-scale distributed systems such as real time pricing systems, meter reading systems, and customer information systems.

In any case, a consumer portal provides a single point of access for multiple organizations to gather data from a variety of customer premises equipment. It is a "window" or "portal" into the customer site.

Why are we talking about portals?

It is vital that the power industry develops a common approach to consumer portals. The reasons for this urgency fall into the general categories of frustration, regulation, and evolution.

Frustration

A common approach to consumer portals is necessary to reduce the expense and frustration caused by repeated attempts to develop proprietary solutions.

Over the past two decades, many utilities and vendors have attempted to implement consumer portal systems, with a notable lack of success. Although the benefits of a portal system appear obvious to many, none have been able to deploy portals on a wide enough scale to make a successful business case.

A **standardized reference model** for a consumer portal is required. Once a reference model exists, vendors and utilities can apply economies of scale to applications like automated meter reading (AMR), demand response (DR), and advanced distribution automation (ADA). This FAQ and survey is a step toward developing such a reference model.

Regulation

A few governments, most notably in California (Figure 2), and Ontario, Canada, have recently begun the process of passing regulations to enable widespread automatic meter reading and demand response. The purposes of such regulations are to "level the playing field" and make the costs of these applications equal for all participants, while ensuring common service for consumers across the government's jurisdiction.

Some would argue that a consumer portal is not strictly necessary to meet such regulations. Certainly, AMR, DR and advanced energy distribution could be implemented without a separate physical device called a "portal".

Figure 2 Capitol Building, Sacramento California

However the abstract *idea* of a portal, as described in this paper, is inseparable from these applications. It is this "idea" that needs to be standardized.

Evolution

The power industry has recently received pressure to adapt on four different fronts:

- **Reliability.** Incidents such as the 2003 northeast blackout (Figure 3) have pointed out that the grid is "brittle", i.e. susceptible to major outages resulting from failures in a few key locations.
- **Security.** Recent terrorist attacks have highlighted the vulnerability of the power infrastructure to cyber attack.
- **Markets.** Deregulation and the opening of energy markets have forced unprecedented sharing of information between utilities.
- **Consumer Input**. Lack of funding for new generation from traditional sources, new sources of distributed generation, and increased demand for high quality power are driving the need for consumers to have input into the daily operation of utilities

Figure 3 Satellite Photo of 2003 Blackout

.

Each of these factors emphasizes the need for high volumes of timely, accurate information about the current state of the power grid, all the way out to the consumer site.

The IntelliGrid Consortium, an organization of utilities, vendors, researchers and governments, has been formed to address these pressures. The logo of this consortium (Figure 4) indicates its goal of enabling a power grid communications system that will be integrated into the new "digital society".

The IntelliGrid Architecture, described at www.epri-intelligrid.com, proposes a structure for a power system communications network that will help the grid automatically predict failures, heal and optimize itself, and interact with both customers and markets.

The concept of a consumer portal is a key piece of the IntelliGrid Architecture, because it will provide the volume and accuracy of data necessary to enable the simulation, modeling, and predictive maintenance necessary to achieve these goals.

Figure 4 The IntelliGrid Logo

How would a portal be used?

A Peak Day Arrives. It is a sunny day in California with a forecast high temperature of 105 degrees – the fifth consecutive day of high temperatures above 100. The California ISO predicts that an all-time

system peak will be established today due to this "heat storm". As a result of this forecast, the previous day the ISO called for a curtailment to be implemented today. Energy service providers (ESP) responded by signaling their customers participating in demand response programs that a "super peak" tariff rate would be in effect today.

When the ESP's received notification from the ISO of the curtailment, large customers we notified and invited to bid specific demand reduction into the market. Simultaneously, notice of the super peak period was posted on the ESP's server.

A Portal Reacts

The Consumer Portal device located at a restaurant participating in the demand response program in Ontario, California periodically checks the ESP's server for super peak activation information. Previously, the restaurant owner used the web-based user interface provided in the local Consumer Portal hardware to specify what load control actions would be taken automatically in response to a super peak event (Figure 5).

Based on these options, the Consumer Portal hardware utilizes local communications (a field bus) to program the restaurants thermostats to implement a 4 degree setback during the curtailment period. This particular system will change the setting only when the super peak event arrives; a more sophisticated system might pre-cool the restaurant prior to the peak in order to better coast through the curtailment period.

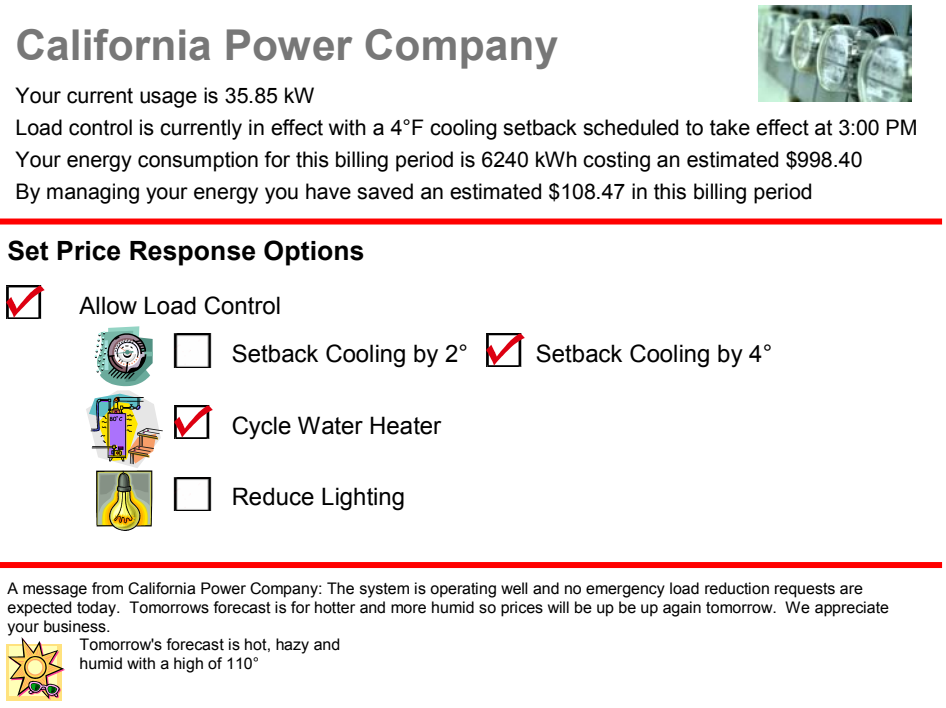

Figure 5 Example of Possible Consumer Portal Web Interface

In addition, the portal has set an internal rule set that will send a load control signal over the field bus (X10 power line carrier in this case) at the proper time to turn off the water heater. Today, when the super peak event occurs, the thermostat controlled the HVAC system to increase ambient temperature by 2 degrees during the curtailment period and the Consumer Portal directly controlled the water heater load to turn it off during this time. The result of these actions on the load shape can be seen in Figure 5.

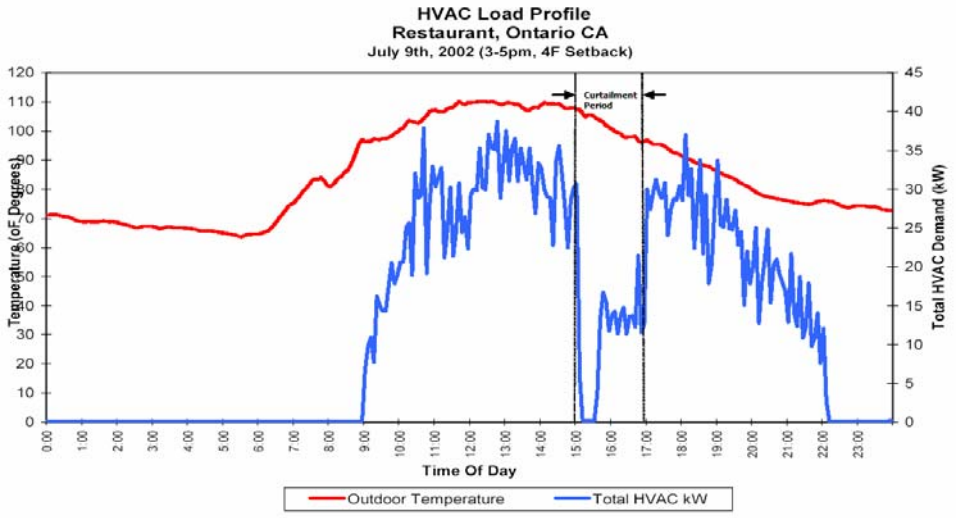

Figure 5 – Result of Response to Curtailment Event

In this example, the HVAC load was initially reduced to zero at the beginning of the curtailment interval when all HVAC units shut down after receiving the setback command and then settled down to around half of the normal load once the units started cycling to support the new set-point.

The customer was able to inspect the user interface to see that a curtailment was called for, but if they did not, the control action would have taken place anyway. The customer is able to use the interface to see what their energy usage and cost is so far this period and what the savings are due to their choice of this rate and load control system. On a regular basis, the customer can see the restaurant's energy usage and observe the benefits of selecting more energy-efficient equipment.

Responding to an Emergency

Simultaneously, in another part of the system, trees contacting some lines result in a permanent fault that trips off a major transmission line. The loss of this line results in other lines being overloaded and the ISO must issue an emergency load reduction request. The consumer portal at the restaurant detects this signal and based on the customer's pre-set configuration information, immediately sets back the thermostat by 5 degrees, disconnects the water heater and half of the lighting circuits. In addition, a visual indicator light is activated on the portal to indicate the system emergency condition.

The distribution operator at the Energy Service Provider sees the fault indication and initiates a query of all consumer portals in the area near the fault. The portal at the restaurant responds, indicating it still has

power, but many other portals located nearby do not. Within minutes, the operator can see the extent of the area affected by the fault, and begins taking action to restore power.

This scenario illustrates a consumer portal being used for automatic meter reading, real-time pricing, voluntary demand response, emergency curtailment, outage detection, and coordination of on-site equipment. These are very likely to be common functions of a portal. However, there are many further possible uses.

What could portals do?

Because a consumer portal would sit "at the crossroads" between the customer site and the utility infrastructure, it necessarily would be the midpoint for a variety of applications. It could serve a number of different clients, including, but not limited to:

- Residential and commercial consumers
- Energy service providers
- Independent system operators
- Distribution companies
- Other utilities
- Non-utility organizations

The sections that follow discuss the types of functions a portal could perform for these clients.

Advanced Metering and Demand Response

A consumer portal could serve as the point of contact for advanced automatic metering programs and for reducing load dynamically, as illustrated in Figure 6.

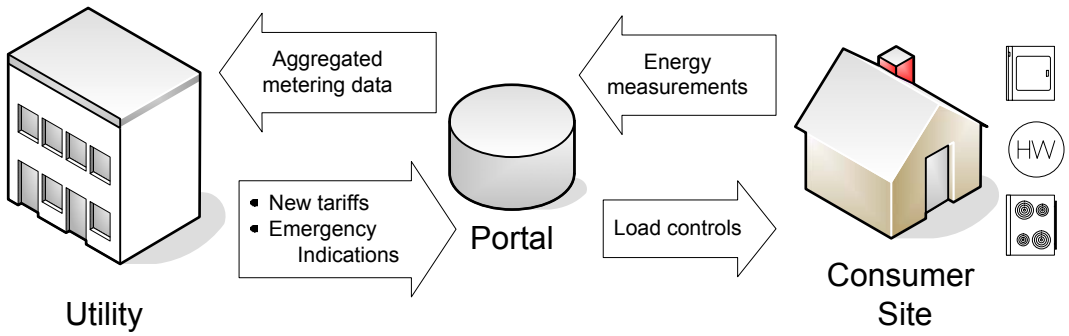

Figure 6 Using a Consumer Portal for Metering and Demand Response

Using the portal, an Energy Service Provider could:

- Read customer meters automatically
- Gather data from multiple meters on a customer site, aggregated or not
- Download new tariff schemes to meters
- Implement Time-of-Use (TOU), variable Peak Period, and real-time tariffs, as illustrated in Figure 7 and discussed in the *How Would a Portal Be Used* section.
- Give customers incentive and tools to voluntarily reduce load by controlling appliances, hot water heaters (HW in the figure) and thermostats.
- Reduce load from participating customers suddenly in emergency situations

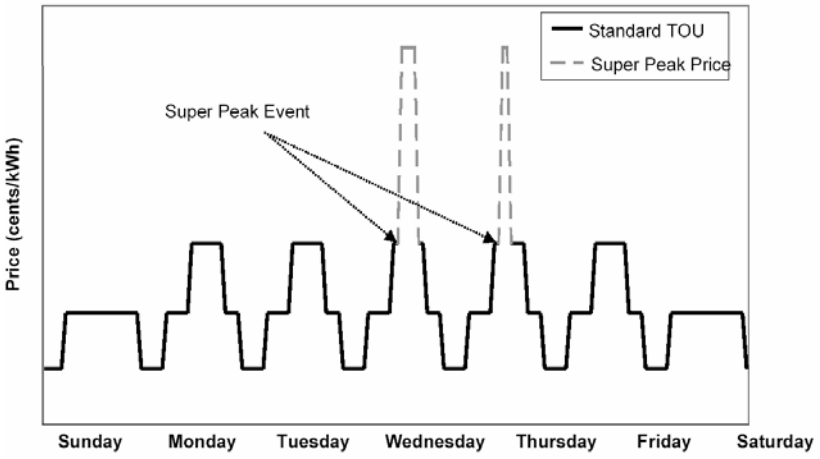

Figure 7 Illustration of Time-of-Use and Variable Tariffs

Residential Customer Services

A consumer portal could serve as the user interface for a variety of new customer services, as illustrated in Figure 8.

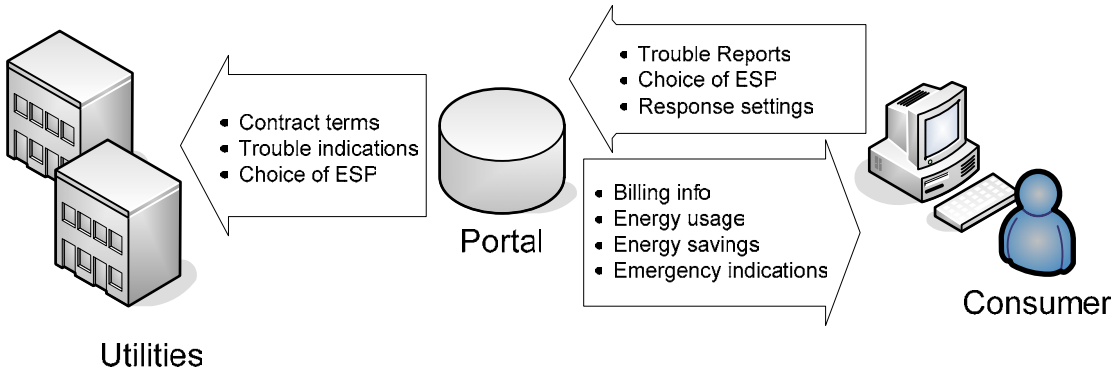

Figure 8 Using a Consumer Portal for Residential Customer Services

Using the portal, a residential customer could:

- Receive indications when emergencies occur
- View power and energy consumption and its cost in real-time
- Receive frequent and/or online billing, and prepay bills
- Choose how loads respond to prices and adjust contract terms
- Choose an energy service provider
- View savings from participating in demand response
- Report service trouble

Advanced Customer Services

A consumer portal could permit more advanced customers to integrate the operations of their site with that of the power system and energy markets, as illustrated in Figure 9.

Using the portal, these more advanced customers could:

- Optimize their energy use by downloading pricing forecasts and load history into their local energy management system
- Compute energy efficiency of appliances and subsystems
- Monitor and control the status of distributed generation at their site or from multiple sites
- Monitor power quality for contractual purposes
- Coordinate load profiles between buildings having the same owner
- Submit bids to an energy market, proposing a price they would accept to reduce their load significantly or to provide distributed generation

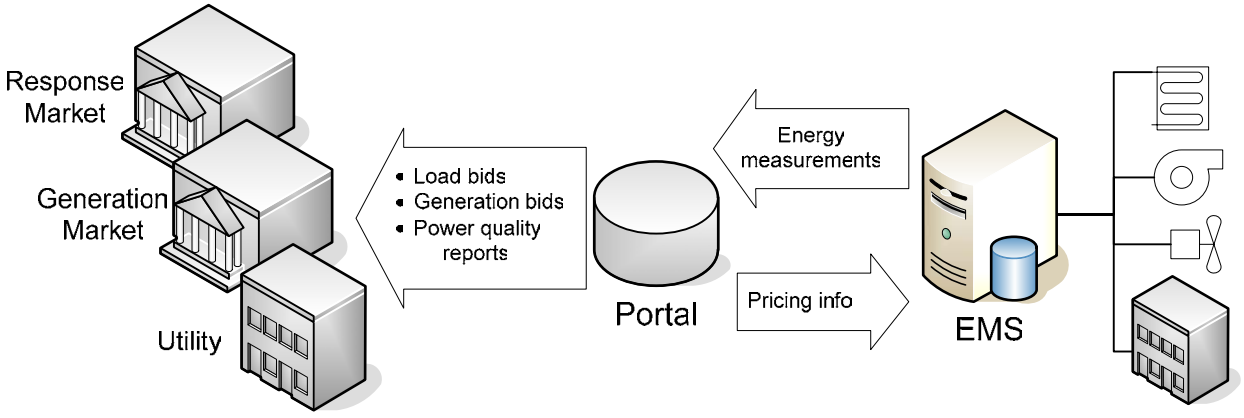

Figure 9 Using a Consumer Portal for Integration with Customer Energy Management Systems

Customer Management

A consumer portal could permit Energy Service Providers to remotely manage their customer accounts, as illustrated in Figure 10.

Using the portal, an Energy Service Provider could:

- Detect theft of energy
- Detect tampering with customer premises equipment
- Remotely connect, disconnect, and configure customer services
- Limit maximum customer load in response to billing irregularities

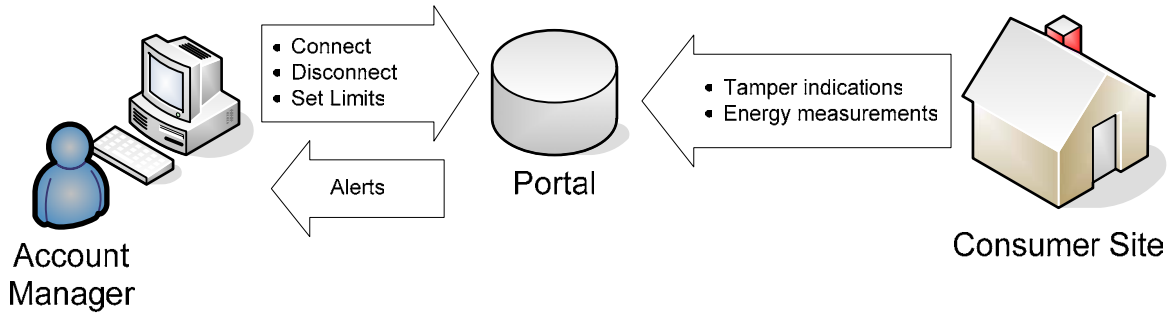

Figure 10 Using a Consumer Portal to Manage Customer Accounts

Widespread Distribution of Data

Consumer portals could provide the large volumes of accurate data necessary to enable sophisticated energy marketing, simulation, modeling, and predictive maintenance applications, as illustrated in Figure 11. Utilities could use this information to greatly improve their efficiency and reliability.

Using the portal, an Energy Service Provider or Independent Service Operator could:

- Provide data to multiple parties for market participation
- Perform better load research and system optimization with more accurate data
- Aggregate data from different utilities, e.g. gas, water, heat
- Stagger load pickup in “black start” emergencies

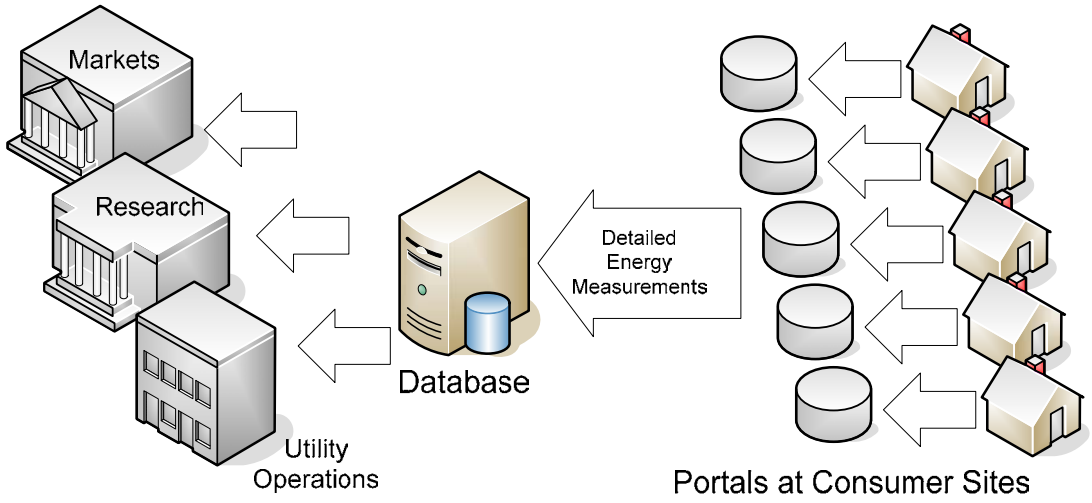

Figure 11 Using Consumer Portals to Analyze Load Data

Advanced Distribution Operations

A consumer portal could permit distribution operators to react more quickly to system trouble and optimize the system down to a consumer level rather than just a feeder level, as illustrated in Figure 12.

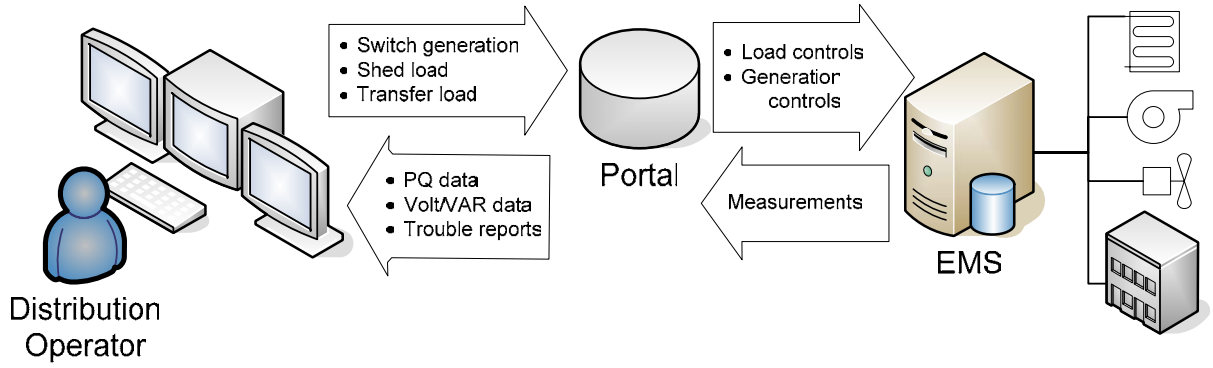

Figure 12 Using a Consumer Portal for Advanced Distribution Operations

Using the portal, a Distribution Company operator could:

- Detect and isolate network outages more quickly through automatic notification of outages and integration with outage management systems
- Shed load with finer control in emergency situations
- Redistribute load by using demand response customers as a "fast reserve"
- Monitor and optimize power quality more accurately based on data from customer

- Monitor and control voltage and VARs with finer control using customer data, and possibly by controlling them at the customer site
- Monitor and control distributed generation at the customer site
- Minimize system losses by reading more accurate data from customer premises

Non-Energy Applications

Once consumer portals are widely deployed, they could be used for a variety of applications not related to energy use, but requiring a point of contact at the consumer site, as illustrated in Figure 13. In these cases, the consumer portal specification would not describe such non-energy services in detail, but instead would specify the framework for other providers to do so.

Using the portal, utilities could provide services or infrastructure to remotely:

- Monitor customer premises security and alerts (flooding, freezing, etc…)
- Monitor health of home-based patients
- Provide entertainment or communications
- Forecast environmental conditions (weather, earthquakes, floods…)
- Monitor indoor air quality
- Control and optimize building heating and lighting
- Diagnose and perform maintenance of customer equipment

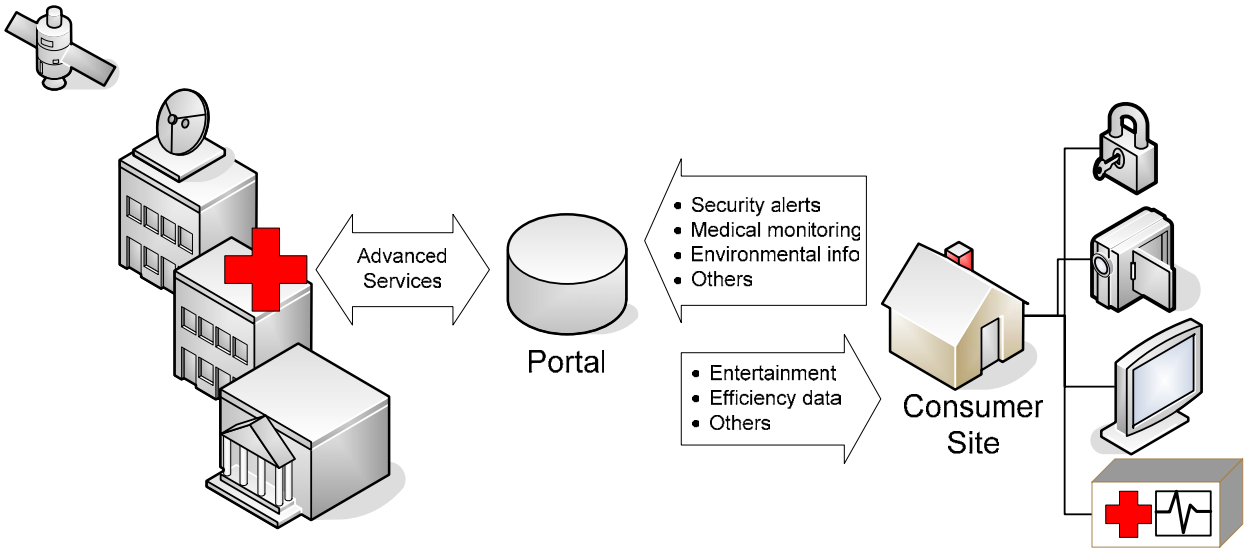

Figure 13 Using a Consumer Portal for Non-Energy Applications

Which functions are most important?

The previous sections illustrate that the list of jobs a portal could do is long and varied. To make portals a success, the industry should initially focus on a few functions that will be most important. However, it is also vital to plan for the future and not leave "stranded assets".

Figure 14 summarizes initial responses from eleven utilities that are members of the IntelliGrid consortium members about the priority of portal functions. The list of functions has been simplified down to ten main areas. To give your opinion, see the *Features and Functions*

Features and Functions section under *What do YOU think?*

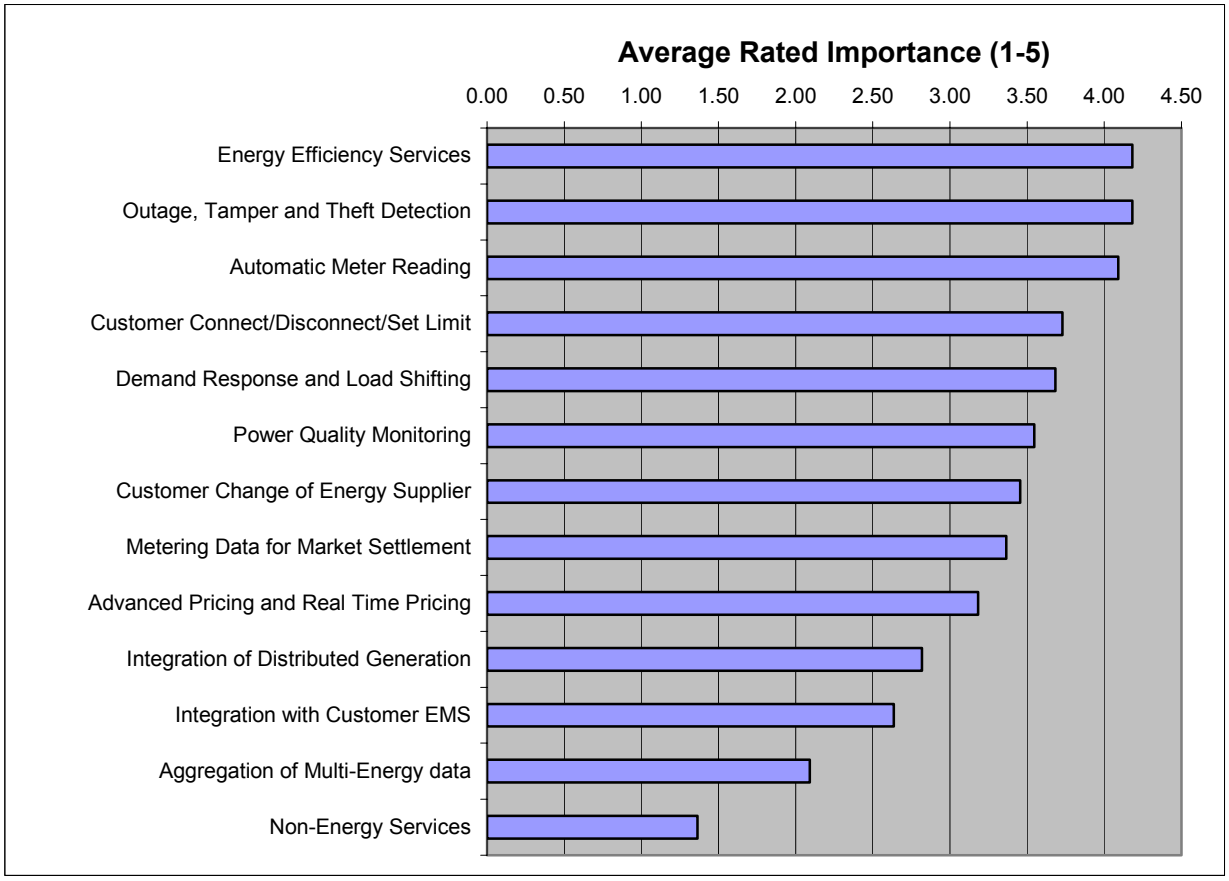

Figure 14 Initial Feedback on Portal Function Priorities from IntelliGrid Consortium Members

How could portals make money?

This section discusses the business case for deploying consumer portals.

Benefits

The business reasons for deploying consumer portals include:

- Increased system efficiency, stability and power quality due to large amounts of accurate data arriving from customer sites
- Cumulative energy cost savings to the utility and to the consumer, arising from demand response and better information provided to the customer
- Avoided costs of incremental capital investment by the utility, especially in generation
- Recovered costs to the utility from theft detection

- Recovered costs to service providers from manual meter reading
- Recovered costs to utilities, industry, and other consumers due to shorter and fewer outages
- New income to utilities from providing value-added services to consumers
- New income to utilities and ISOs from participation in energy markets with better data

Barriers to Entry

The benefits of consumer portals must be balanced against some significant barriers to entry:

- Cost of the portal itself (unless it is embedded within other devices)
- Cost of deploying networking to the customer site (if an existing network is not available)
- Cost of deploying networking *within* the customer site, as needed
- Cost of installing any new portal peripherals e.g. meters, thermostats, EMSs
- Cost of signing up customers to participate
- Cost of creating technical support and billing infrastructure

Analyzing the Potential

A study sponsored by the Electrical Power Research Institute (EPRI) in 2004 attempted to quantify the costs and benefits of deploying consumer portals in California. The results are summarized in Figure 15.

The study was based on a 5-20 year assessment using a 15% discount rate. The result showed a state-wide net present value benefit of almost $15B, or $12,000 per device over this lifetime.

It is important to bear in mind that this figure is the 'excess' value of the investment to society after the investing entity owner has earned a return on equity of 15%! This excess essentially represents additional 'societal value' that is then available to be 'split' amongst the appropriate parties.

Naturally, some of this 'societal value' would be effectively passed on to customers in the form of the value of more reliable, stable, and available power while other contributions could be directly passed on to customers in the form of provisional discounts once the savings are realized. What this really means is that regulators would have considerable latitude in providing customers or society in general a negotiated portion of the total benefits.

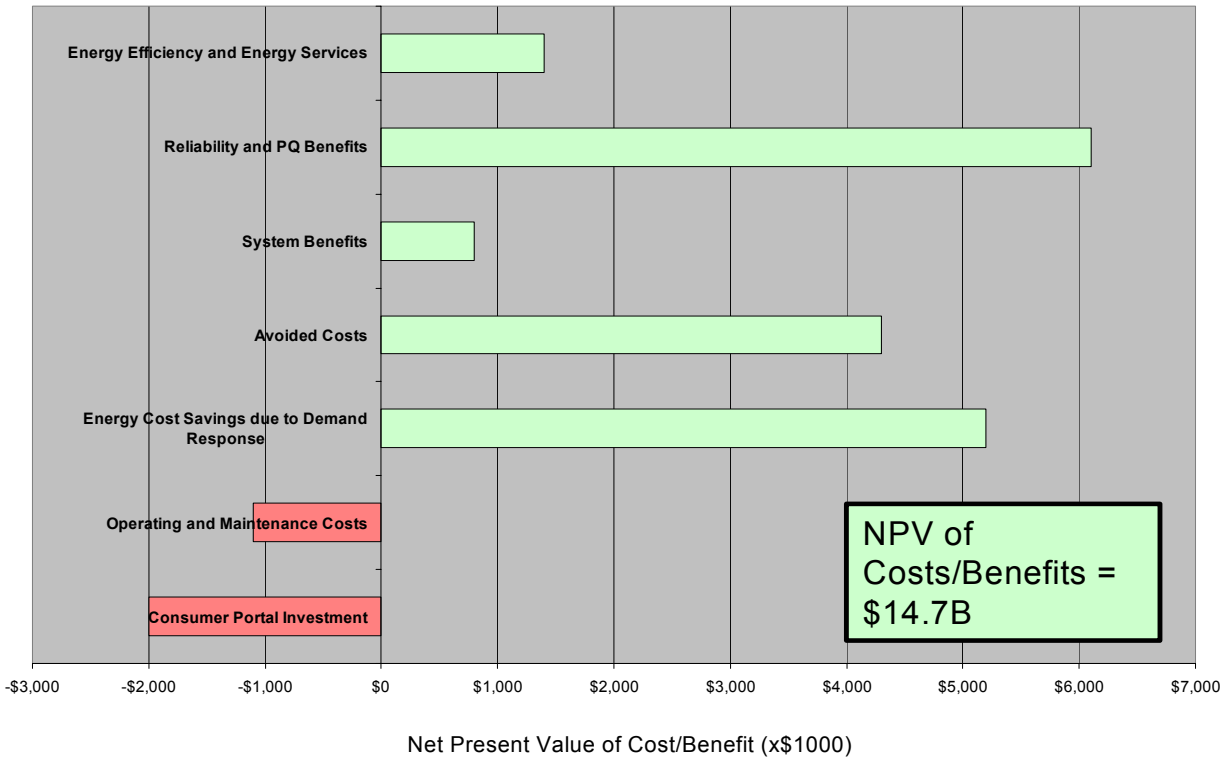

Figure 15 Predicted Costs/Benefits of Consumer Portal Deployment in California (EPRI study)

Lessons Learned from Past Attempts

EPRI also performed an analysis of several attempts at deploying consumer portals over the past two decades. The following lessons can be learned from these failed attempts:

- **The technology exists.** No technological breakthroughs are necessary to reap the benefits of consumer portal applications. Finding a way to distribute the benefits and offset the startup costs is the main challenge.
- **Make it simple.** Portal services must be implemented in a way that requires very little participation by the consumer unless the consumer chooses to do so.
- **Standardize.** Most portal attempts failed because they used proprietary technologies or attempted to "lock in" consumers to a particular vendor. The necessary economies of scale will only occur when multiple vendors can address a market that is statewide or nationwide in scope. This will only happen through use of standard, open technologies.
- **Share the infrastructure.** The energy industry has not made effective use of the communications infrastructures being deployed by other industries. Although almost all utility portal commercialization efforts have failed, there are dozens of successful cases of portal-like services being offered to consumers by other means. These include cable, telephony, wireless internet and security monitoring services, among many others.

- **Build an architecture.** Too often, organizations have created "islands of automation" in the power industry, without considering their impact on the rest of the grid. Any consumer portal implementation must be integrated with the entire utility communications system, from markets, to contingency analysis, to transmission and distribution automation and protection, to asset management, and so on.
- **Don't strand assets.** The list of portal functions described in this document is likely to be small compared to the potential future uses. Therefore, consumer portals must be easy and inexpensive to upgrade so that utilities and other organizations can add new applications as they arise.
- **Share the benefits.** The industry must discover business cases and organizational structures that permit the "societal" benefits from deploying portals to be shared.

One likely means to learn from these lessons is through the participation of governments. If all participants in the market are regulated so that costs of consumer portal applications are required of all participants, businesses are more likely to consider deploying portals.

What could a portal look like?

A consumer portal is an *idea*, not a particular device. Its virtual appearance *must* be standardized, in order to ensure interoperability and to bring down costs through economies of scale. However, a consumer portal may be physically implemented in a variety of ways. The sections that follow briefly describe a few options. Please note that these are examples only.

Possible Portal Locations

There are a number of places that a consumer portal could be implemented. Some of them are illustrated in and Figure 16 and Figure 17 **Examples of some possible portal locations**

- Portal as a stand-alone device
- Portal inside a meter
- Portal inside a thermostat
- Portal inside a set-top box or cable-modem
- Portal on a PC
- Portal as part of a local EMS
- Portal inside one or more appliances

Note that in most of these cases, a separate physical portal device does not exist at all.

Vendors already provide portal-like functionality in some of these locations. However, most of these implementations are not interoperable with other vendors or based on open standards. A standard definition of a consumer portal is required, independent of vendor, technology, or location.

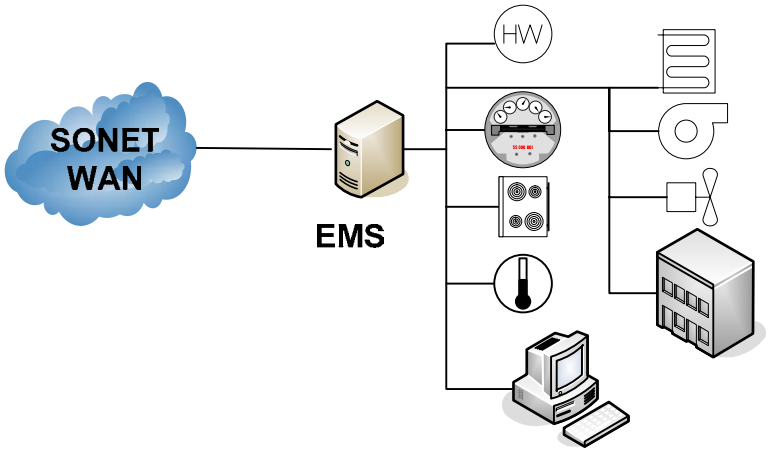

Figure 16 Example of a Portal Located Within a Customer EMS

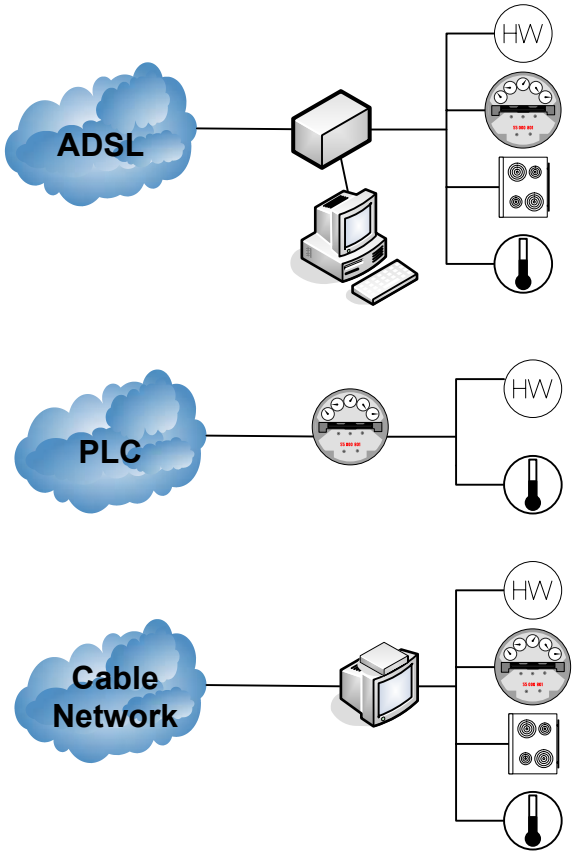

Figure 17 Examples of some possible portal locations

Possible Portal User Interfaces

A consumer portal could have any of the following interfaces:

- A web-based interface, as discussed in the opening scenario of this document.
- A TV interface, providing similar features to the web but through set-top-box.
- A few buttons to select a level of response and a light to indicate an emergency.
- A single light to indicate the level of rates being applied.

What do all these portals have in common?

Regardless of how they are implemented, all consumer portals need to have some common characteristics in order to achieve interoperability and economies of scale.

- **A common minimum data model**. Each of these implementations would provide the same basic "face" to its electronic clients. Vendors would be encouraged to add to this minimum in order to promote innovation and value-added features.
- **A common security scheme** to provide a united front in protecting data from attackers, and to guarantee privacy between the various users of the portal.
- **A common upgrade mechanism** so that utilities can download new tariffs, configuration, and applications electronically, to prevent portals from becoming "stranded assets".
- **A common management method** so devices from a variety of vendors can all be monitored, diagnosed, and controlled in a common manner.

What may be different?

The purpose of a portal is to provide a single common view of customer premises equipment. Because of the portal, the following items can be customized according to the needs of a particular project:

- **In-building communications technology**. The physical technology used to connect devices at the customer site may vary. The portal hides this detail from its clients.
- **Wide-area network technology**. There may be a variety of mechanisms used to communicate between the portal and its clients, although the topmost level of communications, the data model, must remain common.
- **User interface.** Vendors would be encouraged to innovate in how the consumer would view data and control the functions of the portal.

What do YOU think?

Do you agree with the views discussed so far in this list of frequently asked questions? Here's your chance to change them. Please email to …. or fax to …

Contact Information

Please tell us who you are and provide information so we can contact you. Attach a card if you prefer.

Name: _____

Title: _____

Organization: _____

Address: _____

City: _____ State/Province _____

Postal Code: _____ Country _____

Phone: _____

Email: _____

Purpose and Use

1. Would you advocate using consumer portals (Yes/No)? Please explain.

2. What is the most important purpose of a consumer portal?

3. What would you use a portal for?

4. Where would you use it?

Features and Functions

5. Which of the features discussed here are most important? Add any items you think are missing or deserve special focus.

Function	Rating: 1-5 5 = most important
Automatic meter reading (AMR)	
Energy Efficiency services	
Metering data for market settlement	
Advanced pricing and Real Time Pricing	
Customer Management	
Demand Response and Load shifting	
Aggregation of multi-energy data	
Integration of distributed generation	
Support of advanced distribution operations	
Integration with Customer energy management systems	
Non energy services	

Table 1 Survey of feature priorities

6. Which features discussed here are impractical or not useful?

7. Which features would you most regret not having in five years?

Business Case and Barriers

8. What are the best business reasons for deploying portals?

9. What are the main barriers to deploying portals?

10. What steps would reduce some of these barriers?

11. What should a consumer portal cost?

Location and Form Factor

12. What form factor would you prefer for a portal?

13. What form factor could you not permit for a portal?

Communications

14. What communications technologies would you prefer to use at a customer site?

15. What communications technologies would you prefer for a WAN?