Fraunhofer USA

Home Energy Management Products & Trends

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1.1 INTRODUCTION

Ongoing technology trends, including decreased sensor, computation, and display costs, more pervasive integration of device-level information processing capability and networking/communications, an increased interest in electric demand response, and the roll-out of smart utility meters have greatly increased the opportunities for home energy management and enhanced their potential viability. To exploit those opportunities, a growing number of new Home Energy Management (HEM) products and companies have come emerged over the past decade, ranging from basic energy displays to whole-home control systems and smart phone apps. The great diversity of HEM product features and types points is indicative of the emerging state of the HEM industry that currently has relatively low market penetration. For example, Greentech Media (2011) estimates that approximately 6 million U.S. households will have some type of HEM device by 2015; this equals about 5 percent of households.

Put another way, the "killer app" of HEM has yet to surface.

Some HEM systems strive to increase communication between the utility and the consumer. The directionality and sophistication of such communication, however, still varies among products. Many products that seek to provide real-time feedback on electricity consumption send information to the consumer only. The growing trend, rather, is to develop two-way HEM products that can connect to a home area network (HAN) and *control* different devices in the home; such is the case with current home automation (HA) and demand response (DR) efforts. In that case, the end-goal of HEM and smart grid at the residential level is to manage energy consumption profiles to reduce peak electric demand and reduce consumers' electric bills. This may reflect the gradual progression to a smart grid, but may also be due to challenges with homeowner adoption and effective use of feedback systems (e.g. home energy displays (HEDs)) that were initially developed.

For any HEM system to achieve mass-market penetration, the industry must overcome challenges to enable consumers to easily sell, install, manage, and secure HEM solutions (Cisco, 2010). As noted above, HEM is currently a smaller, emerging market. Moreover, some of the most significant players on the market (i.e. Google, Cisco and Microsoft) have decided to exit the industry, citing a lack of growth and consumer interest. Current research should be focusing on this general lack of market acceptance. Moreover, the success of HEM products depends largely on how home occupants act upon the energy feedback itself (and, to what degree). Therefore considering user preferences and providing relevant, actionable information should be a point of focus.

Perhaps the biggest barrier to greater deployment of HEM is that consumers currently need to invest in additional tools (e.g., home energy displays [HEDs], software, sensors, etc.) to obtain real-time feedback on their electricity consumption (ACEEE 2010). This makes for a market filled with early adopters and technology enthusiasts. Consumer research suggests that the average user is not yet willing to learn the necessary information to install and navigate current products (SGCC 2011). A clear example of this in the current market is that of programmable thermostats, which are typically used successfully only by approximately 50% of home occupants and do not yield clear energy savings relative to nonprogrammable thermostats (Meier et al. 2011).

The Fraunhofer Center for Sustainable Energy Systems (CSE) leads the Building America HEM Standing Technical Committee. To help guide the STC's discussion of HEM market opportunities and research needs, CSE crafted this Taxonomy of current HEM products, as well as a list of HEM products and their functionalities and prices. All information is current as of September ,2011, and we further seek to update some of the information provided by Herter et al. 2010 (see Appendix). While we made an effort to be all-inclusive, many products that have been announced publicly have yet to become available for purchase. In addition, potential industry leaders such as Google and Microsoft are shifting product focus, reflecting the dynamic and emerging nature of the HEM market.

1.2 TAXONOMY

We have devised the following classification system for all types of HEM products available in the residential market (see GreenTech Media 2011 for a HEM vendor taxonomy). The three basic categories are:

1. Control Devices
2. User Interfaces
3. Enabling Technologies.

These categories are not mutually exclusive, but are meant to capture the key aspects of typical HEM devices. Individual products may fit into multiple categories. For example, the TED 5000-C package reads usage data using current transfomers, provides data via a displays well as through a web portal or stand-alone software, and uses its own gateway device that communicates using ZigBee. The HEM market today consists of a range of hardware and software solutions that sometimes work with smart meters that are only provided through utilities.

Control devices allow the consumer or utility to actively control energy use, with varying degrees of automation / human-in-the-loop. Table 1 summarizes the different levels of control and representative examples.

Table 1: HEM control levels – descriptions and examples.

Control Level	Description	Examples
Centralized	• Communicates with multiple control devices in the home and allows the user to manage them from a single location • Often multiple inputs	• Home automation (HA) systems • Whole-home lighting control systems • May build on security systems
Device-Level	• User controls a single device or function • Standalone control	• Lighting control with motion sensors, dimmers, remotes, scheduling • Thermostats • Smart plugs • Smart power strips
On-Board	• Control functionality integrated in the device	• Smart appliances, e.g., that respond to grid instability • Office equipment power management • Smart light bulb

User interfaces (UI) provide energy feedback to consumers. *Raw* UIs, also referred to as direct feedback, provide more basic information with limited processing to inhabitants, such real-time and or historic data on energy consumption (in kWh, $/hr, watts/hr, etc.). In contrast, UI's with *processed data*, also referred to as indirect feedback, have the potential give users a better sense of the personal significance of raw usage data and how to act upon that information (Erhardt-Martinez et al. 2010). Examples of processed information include: energy consumption by end use, circuit, or device (disaggregation); historical comparisons / trends; personalized; targeted recommendations, and goal setting. Another important attribute of UIs is the information display medium:

a. *Home Energy Display*: Stand-alone in-home display; often portable.
b. *Web Dashboard/Portal*
c. *Smartphone Application*: Current products typically pull information from an HED and generated processed data (but may also provide raw data).
d. Other (e.g., TV)

Enabling technologies are the underlying framework that supports *obtaining, processing,* and *communicating* information about energy usage (see Table 2). Enabling technologies are not home energy management systems per se, but are integral to their function. Examples of enabling technologies are sensors, data acquisition devices, and communications.

Table 2: Summary of enabling technology taxonomy

Enabling Technology	Description	Examples
Sensing	Acquisition of dynamic variables within the home environment	• Smart meters • Temperature sensors • Occupancy sensors • Time of day
Communications	Physical devices necessary to support the network	• Gateways • Range extenders • Home area networks
Communication Protocols	Standards that allow individual nodes within a network to communicate	• X10 • UPB • Insteon • Z-wave • ZigBee

Sensing data involves acquiring information, often inegrated into HEM systems, about dynamic variables related to HEM. Smart meters gather temporal data on electricity usage. Temperature sensors and occupancy sensors characterize the home environment. Information about electrical usage, temperature and occupancy, combined with external information, such as time of day and weather data, can be used to customize energy management for an individual home. Landis+Gyr and Elster are examples of companies that specialize in smart meters. Many companies, including Digi and Ecobee, offer temperature and/or occupancy sensors.

Communications protocols and standards facilitate communications and may support the home network. Gateways are devices that connect the HAN to the Internet. Range extenders amplify signals to expand the area covered by a single network. Many companies manufacture their own gateways and/or range extenders to be compatible with their HEM systems. Communication protocols standardize and facilitate communications.

1.3 CONTROL

Figure 1 shows several HEM control products available on the market today that don't require a smart meter, categorized by functionality. HEM products can allow the user to monitor energy usage, remotely manage energy usage (such as adjusting the thermostat while away from home), and automate energy savings, either with sensors or via user-programmed schedules.

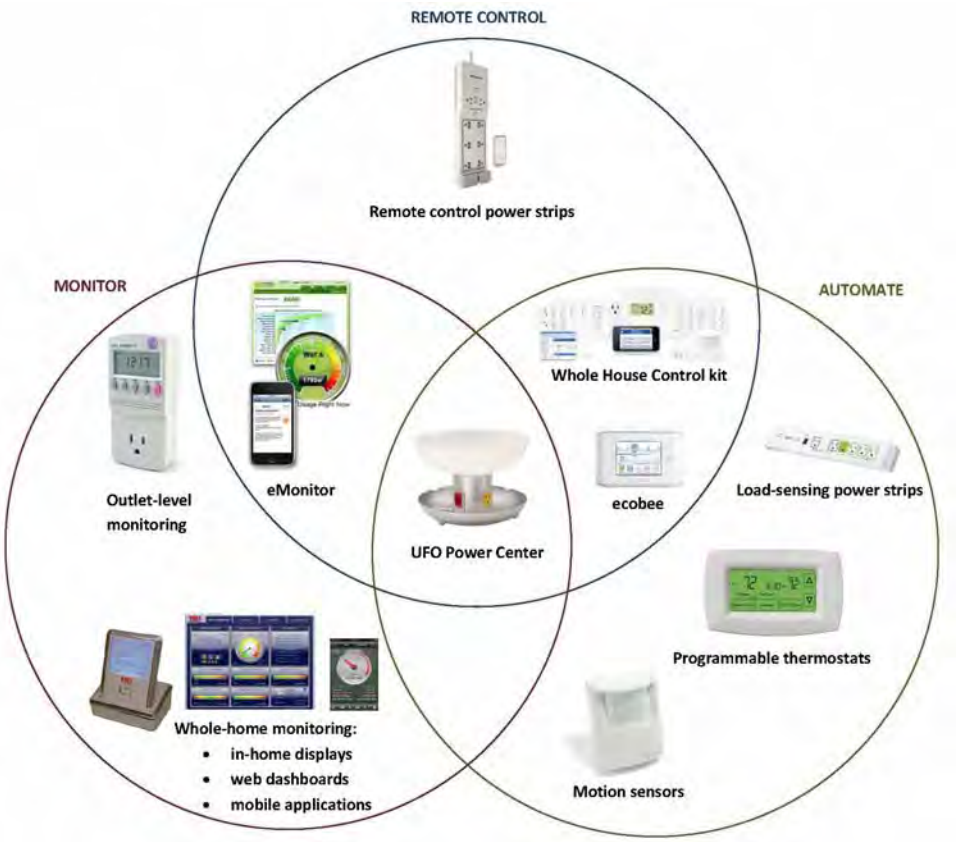


Figure 1: Available HEM products that do not require a smart meter, categorized by user functionality.

For instance, smartplugs, such as the Kill-A-Watt by P3 International, analyze and display energy usage at the outlet level. Whole-home systems usually use some combination of current transformers (CTs) to measure electricity usage at the circuit level, along with a wireless network to communicate the data to a home energy display (HED), such as The Energy Detective. Further, some monitoring systems like the eMonitor also provide software or a web application to view aggregate data on a personal computer or online.

1.3.1 Centralized Control

1.3.1.1 Ongoing Development in Home Automation (HA)

Because of its potential to manage electricity consumption and demand for multiple end uses, HA is an integral HEM subsector. Although several companies sell HA products, many of these products are still being developed and not always and readily available for purchase.

Erhardt-Martinez et al. (2010) argues that the future of HEM is likely to involve a complex network of wireless, consumer-controlled, HA "set and forget" systems. It also lists several companies currently developing consumer HEM systems, including Control 4, Energate, EnergyHub, and Tendril.
Other companies and ongoing developments can be found as part of our larger review in the Appendix.

1.3.1.2 Lighting

Advanced lighting controls allow homeowners to dim lights to lower energy use and turn lights off via occupancy sensors, timers, schedules, or remote control. Lighting control can be at both the centralized and device levels.

Table 3: **Advanced lighting control companies & products.**

Company	Areas of interest	Product on market?	Product list
Lutron	HA, lighting	Yes 	Dimmers, timers, occupancy sensors
Control4	HA, lighting, HVAC	Available through dealers 	Wireless dimmers, wireless switches for controlling remotely
HAI	HA, lighting, HVAC	Yes 	Home control system can incorporate lighting control (motion sensors, dimmers, remote control, scheduling), thermostats, load control modules, and appliance modules
Smarthome	HA, lighting, HVAC	Yes 	Remote control dimmers (INSTEON), appliance control, thermostats

1.3.2 Device-Level Control

1.3.2.1 Thermostat

With space heating and cooling comprising more than half of residential energy consumption (http://buildingsdatabook.eren.doe.gov/ChapterIntro2.aspx), smart thermostats are an important element of a home energy management system. A smart thermostat is a thermostat that can communicate with other devices (either with a smart meter or over a home network). This differs from a programmable thermostat that can only be programmed to automatically reach different temperatures at different times. The most advanced of these products can be controlled and monitored remotely. The price range of programmable/smart thermostat products can be anywhere from $100 to $500. These products tend to have more HA capabilities than other HEM products on the market today.

In recent news, Honeywell has partnered with Opower to develop HVAC feedback capabilities, including energy analysis at the thermostat display level (http://news.cnet.com/8301-11128_3-20105529-54/smart-thermostats-to-get-smart-cloud-software/).

Table 4: Thermostat companies & products

Company	Relevant End Uses	Product on Market?	Product list	Notes:
Control4	HVAC, HA	Available through dealers 	Wireless thermostat can be programmed remotely with energy controller (gateway, IHD)	
ecobee	HVAC	Yes 	WiFi-enabled smart thermostat with touchscreen, web portal, iPhone app	Available through contractors; $338 on Amazon.com
EnergyHub	HVAC, HA, MELs[1], FB[2]	Yes 	Wireless thermostat, functions with home base for monitoring and control; smart socket; smart strip	$99 thermostat; $299 home base and thermostat bundle

[1] MELs = Miscellaneous and electronic loads.
[2] FB = Feedback.

Company	Relevant End Uses	Product on Market?	Product list	Notes:
Honeywell	HVAC	Yes 	Programmable thermostat with touchscreen	Requires professional installation; $248 on Amazon.com
Tendril	HVAC, DR, HA, MELs, FB	Only available through utilities 	Smart thermostat; smart outlet; in-home display; load control switch; gateway	

1.3.2.2 Smartplugs/strips

Plug-level solutions offer monitoring, control, and even automation at the level of individual sockets. The price range typically ranges from $20 to over $200. A smart power strip generally has one or more "always-on" plug(s) for the T.V. control box, and five or so plugs that (manually or automatically) turn off the other entertainment devices when not in use. A more expensive smart power strip, such as the Belkin Conserve, will also have a "control" appliance that automatically turns off all of the other plugged-in devices when the control appliance is turned off (ACEEE, 2010).

Table 5: Smartplug companies & products

Company	Products	Product image	Pricing
Belkin	Conserve series: plug monitoring, smart power strip, remote, timer		$30 outlet monitor, $30 smart strip, $10 timed outlet
EnergyHub	EnergyHub starter kit: smart socket, smart strip, home base		$325 starter kit; $40 socket, $90 strip when sold separately; monitoring and control
P3 International	Kill A Watt series: outlet level monitoring with wireless display available, power strip, timer (automation)		$99 for wireless display, $99 for each wireless plug (monitoring only)

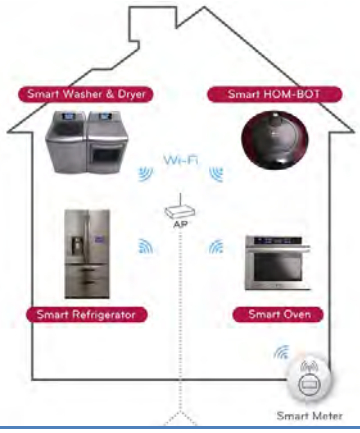
Company	Products	Product image	Pricing
PlugWise	Plugwise Home Basic (8 smart outlets, USB stick for wireless communication, software)		$299 for 8-plug monitoring, control, and automation
ThinkEco	Energy-saving modlet starter kit (5 2-plug sockets, USB receiver, monitoring/control software)		$355 for 10-plug monitoring, control, and automation
TrickleStar	Smart power strip, Z-wave USB stick, Z-wave remote control		$35 smart strip, $35 USB stick, $40 remote (energy monitor available through utilities?)
Visible Energy	UFO Power Center (four-outlet, smart power strip with iPhone app)		$99 for four-socket monitoring, control, and automation

1.3.3 On-Board Control

These companies are working to enable home appliances to communicate with smart meters, although companies like Whirlpool are developing appliances that do not need a smart meter.

Table 6: On-board companies & products

Company	Product on market?	Product list	Notes
GE	No; "widely available 2011" 	Network-communicating appliance suite: dishwasher, double-oven range, front-load washer & dryer, refrigerator; programmable thermostat, energy display, smart phone app, web portal	Automatically delays appliance use until off-peak hours; requires AMI Zigbee smart meter
Google	No; Android-controllable LED light bulb expected by end of 2011	Android@Home protocol for controlling home appliances and thermostats with Android devices; Android-controllable LED light bulb in	

Company	Product on market?	Product list	Notes
		development with Lighting Science Group	
LG	No 	THINQ smart appliances display energy consumption and can be scheduled to run at off-peak hours: washing machine, dryer, oven, refrigerator	Supports WiFi and Zigbee to communicate with smart meter and smartphones
Whirlpool	Yes 	Energy-efficient refrigerator with built-in sensors to automatically adjust cooling; oven with energy save mode; washers and dryers with eco monitors that provide feedback on the eco-friendliness of the user's choice of cycles.	

1.4 USER INTERFACE

1.4.1 Raw Data–HEDs

Many HEDs provide real-time electricity monitoring of the entire home in current kW, $/hr, or daily kWh. Currently available models tend to be similar in the general types of information and visualization they present to the user, and do not provide household controls. Installation for these models typically involves current clamps on a home's circuit panel (thus, does not interact with a smart meter).

Table 7:HED companies & products

COMPANY	PRODUCT	COST	IMAGE
2 Save Energy	**The Owl Micro** Battery-powered wireless display. 90-foot range. Breaker panel installation.	$77.25	
	The Owl Battery-powered wireless display. 90-foot range. Stores 2 years historical data. Breaker panel installation.	$139.95	
AlertMe	**Energy Monitoring Start Kit**	starting at £50	
Black and Decker	**Home Power Monitor** Battery-powered wireless display. 60-foot range from meter. Access data remotely with upgrade accessory ($159, $114 Amazon). Electricity meter sensor.	$99.99 ($24.99 Amazon)	
BlueLine Innovations	**PowerCost Monitor** Battery-powered wireless display. Access data remotely with upgrade accessory ($159, $114 Amazon). Electricity meter sensor.	$109.00 ($72.00 Amazon)	
Brultech	**ECM-1240**	$170-600	
CurrentCost Ltd	**ENVI** Tabletop display with power supply. Access data remotely with upgrade accessory ($69). Stores 7 years historical data. Breaker panel installation.	$129.00	
	EnviR	£30-50 (UK)	

COMPANY	PRODUCT	COST	IMAGE
DIY Kyoto	**Wattson display + Holmes software**	£100 (UK)	
Eco-eye	**Elite 200**	£90 (UK)	
	Eco-Eye Mini	£90 (UK)	
Efergy	**Elite** Battery-powered wireless display. 230-foot range. Breaker panel installation.	$123.76 ($109.87 Amazon)	
	E2 Battery-powered wireless display. 230-foot range. View data on computer with software. Breaker panel installation.	$138.05	
eGauge	**eGuage Kit**	$752	
Energy, Inc.	**TED 1000 Series** Stationary display. View data on computer with software. Stores 2 months historical data. Breaker panel installation.	$164.95	
	TED 5000 Series Wireless display with charger stand. Access data remotely from computer or mobile. Export data as .csv file. Stores 10 years historical data. Breaker panel installation.	$239.95	

COMPANY	PRODUCT	COST	IMAGE
WattVision	**SaveOmeter**	£80	
	WattVision	$250	

1.4.2 Processed Data

Table 8 summarizes User Interfaces that present processed data.

Table 8: Feature comparison chart for web and phone based energy applications

	Appliance Breakdown	Suggestions/Tips	Email alerts	Social comparison	Social media
MyEragy		✓	✓		
Wattvision			✓	✓	✓
PlotWatt	✓	✓	*		
MyEnerSave	✓	✓			
People Power		✓		✓	✓
TED-O-Meter					
*** Plotwatt supports email alerts for issues with the power sensor, but not energy usage alerts like Wattvision and MyEragy. MyEragy also supports SMS alerts.**					

1.4.2.1 Processed Data – Web Medium

In some cases, displays and supplemental web software packages provide additional information, including household baseline energy use information, energy use trends, projections, alarms, social comparisons, and goal tracking (ACEEE, 2010). Some HED companies develop these capabilities themselves (e.g. EMonitor by PowerHouse Dynamics, $950).

Figure 2: The EMonitor monitors at the circuit level and provides processed data for home energy users.

Other third party freeware options are able to connect to HEDs like the TED or PowerCost Monitor (which has an open platform). This is generally done through a host URL or port forwarding method. Dashboards allow HEM/HED users to view their energy use from anywhere that they have web access, whether on a computer, tablet, or smart phone. Until recently, Google PowerMeter and Microsoft Hohm were the two major competitors in this area. Currently, early adopters must find a replacement to continue to monitor their home energy use on the web. A number of new freeware options have been reviewed below (for a study of device-specific interfaces see LaMarche & Sachs, 2011). While some of these services claim to offer advanced features that go beyond what Microsoft and Google had, such as appliance-level breakdown of energy use, they are predominately still in the beta testing phase.

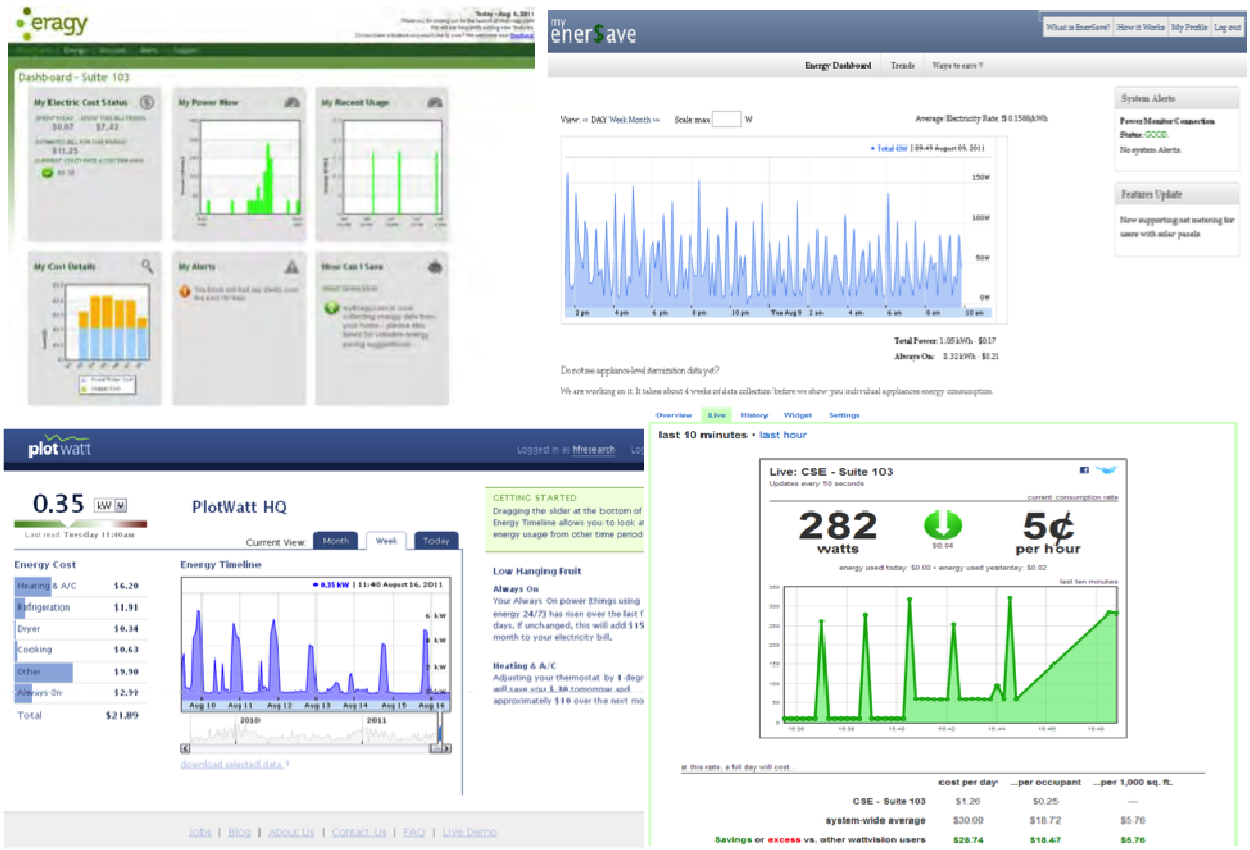


Figure 3: Screen captures of the four free energy dashboards, clockwise from left: MyEragy, EnerSave, Wattvision, and Plotwatt.

Freeware Capabilities

- MyEragy offers energy and cost breakdowns and allows the user to request email or SMS alerts when usage exceeds a threshold set by the user. MyEragy also promises custom energy-savings tips, although like PlotWatt and EnerSave, it must collect data for a certain period of time before these are available. It does not disaggregate energy consumption by appliance.
- EnerSave is one of the two dashboards that promise appliance-level breakdown of energy use data, a feature that would make it easy for consumers to understand how much energy different devices in their homes consume. The drawback is that three to four weeks of data collection is required before that level of feedback becomes available. Until then, the user can only see a chart of total power use viewed by day, week, or month. The risk of this long waiting period before the dashboard becomes more interactive and useful is that the consumer may lose interest.
- Wattvision offers a social component that gives it a unique advantage when compared to the other dashboards. Users can browse other Wattvision-enabled houses by location, view data from houses that choose to share publicly, and see rankings for the houses that used the least energy per occupant the day before. Wattvision also compares the user's estimated energy cost per day to the system-wide average. However, Wattvision does not provide any tips or suggestions for how the user might save on energy use. Additionally, to collect data

continuously from the TED, the user must constantly have a program running on a computer, which puts Wattvision at a significant disadvantage to the other dashboards (and consumes additional energy!).

- PlotWatt, like EnerSave, promises the ability to break down energy data into use by individual appliances. However, also like EnerSave, it takes at least a week of data collection before this information (and customized tips based on it) is available. Of the two, PlotWatt has the more pleasing interface, but has the same risk that users may lose interest during the initial data collection period when there is not much to play around with on the dashboard.

1.4.2.2 Processed Data – Phone Medium

While most web dashboards can also be accessed through the web browser on a user's smart phone, applications have also been developed specifically for mobile phone use. And, if the current market is any indication, mobile solutions for both monitoring and controlling could be the next big branch in HEM. In fact, recent survey work (LaMarche et al., *in preparation*) has shown that early adopters prefer and are more likely to adopt smartphone applications over web dashboards or HEDs.

Two of the most well-known mobile phone solutions for home energy monitoring are People Power and TED-O-Meter. People Power is available for both iPhones and Android phones and is compatible with both the TED 5000 and the Blue Line PowerCost Monitor. TED-O-Meter is only available on iPhones and only compatible with the TED 5000.

The People Power has been reviewed in Itunes as having a "better UI than web dashboard energy products," which may be true now that Hohm and Google PowerMeter are out of the picture. During our preliminary testing we did find that People Power does have more functionality than many of the freeware options tested above. Further, People Power allows users to set energy budgets, compare their usage to state and national averages, and view recommendations to cut energy bills, and take energy efficiency quizzes or post scores to Facebook.

Figure 4: People Power mobile phone app.

The TED-O-Meter provides the user with basic power use feedback without many bells and whistles. It shows low, average, and peak power use and also allows the user to view energy consumption in dollars

spent or pounds of carbon dioxide emissions produced. What distinguishes it from most of the other available apps is its fairly pleasant user interface. One missing feature of the TED-O-Meter is the ability to view energy history, which users find very helpful.

Figure 5: Figure 6: TED-O Meter phone app.

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APPENDIX

This appendix shows companies that have HEM offerings on the market today with notes about what kind of HEM products they offer and their availability as well as their target customer base.

Company		Home Automation			Monitor				Display Type		Other		
Name, Location		Thermo-stat	Power-strip	Outlet	Physical Smart Meter	Meter Reader	Circuit Reader	Outlet Reader	IHD	Other User Interface	Proto-col	Target Market	Availability
2 Save Energy	*UK*	X	UK only	RC	X	X	Y	X	OWL CM119, OWL Micro	Software	ZB***	R	do not ship to US, but available on Amazon
4Home	CA	?	?	?	?	?	?	?	?	?	ZW	SP	currently in trial version by Verizon
AlertMe	*UK*	X	X	RC	X	Y	Y	Y	Y	Web, mobile	ZB**	R	only available in UK
Ambient Devices	MA	X	X	X	X	X	X	X	Energy Orb, Energy Joule	X	Power -line	U	only available through Consumer Powerline
AzTech	*CA*	X	X	X	X	X	X	X	Aztech Display	X	ZB***	U	requires special request through utility company
Belkin	CA	X	RC	RC	X	X	X	Y	X	X	ZB**	R	pre-order on Amazon
Black and Decker	*US*	X	X	X	X	Y	X	X	Home Power Monitor	X	ZW*	R	Y
Blueline Innovations	*CA*	X	X	X	X	Y	X	X	PowerCost Monitor	PlottWatt, web, mobile	WiFi	R	Y
Brultech	*CA*	X	X	X	X	Y	Y	X	ECM-1240	Software	ZB	R	Y
Control4	UT	Y	X	X	X	X	X	X	EC-100 Energy Controller	Y	ZB**	R	available through special dealers
Current Cost Ltd	*UK*	X	X	X	Y	X	Y	IAMs	ENVI, EnviR, TREC, Classic	Software, web, mobile	ZW**, ZB***	R	Y
Digi	MN	X	Y	X	Y	X	X	X	X	X	ZB**	R	Y
DIY KYOTO	*UK*	X	X	X	X	X	Y	X	Watson display	Holmes		R	not available in US
Eco-eye	*UK*	X	X	X	X	X	Y	Plug-in	Elite, Elite 200, Eco-Eye Mini	X		R	not available in US

Ecobee	*CA*	Y	X	X	X	X	X	X	X	Web	ZB**	U	custom installation
EcoDog Inc	CA	X	X	X	X	X	Y	X	FIDO Home Energy Monitoring	Y		R	custom-fit for each home
Efergy	*UK*	X	RC	RC	X	X	Y	Y	Elite, E2	Y		R	IHD available in US market; other products only available in UK
eGauge	*US*	X	X	X	X	X	Y	X	eGauge Kit	Web	Home-Plug	R	Y
Energate	*CA*	Y	Y	X	Y	X	X	X	Energate Companion	Mobile	ZB**	U, SP	not available to residents
Energy Inc	*US*	X	X	X	X	X	Y	X	TED 5000, TED 1000	FootPrints software	ZB	R	Y
EnergyHub	NY	Y	Y	Y	X	X	X	Y	Y	Y	ZB***	R	Y
GE	*US*	Y	X	X	Y	S	X	X	Y	Software, mobile	ZB**	R	currently only available to utilities, in pilot testing
Green Energy Options	*UK*	X	X	X	X	S	X	X	(wide selection)	Web	ZB	U, C	not available to residents
HAI	LA	Y	X	Y	X	X	X	X	X	Web, mobile	ZB	R	Y
iControl	CA	Y	X	X	Y	X	X	X	Y	OpenHome software	ZW*, ZB**	SP, U	not available to residents
Landis + Gyr	*CH*	X	X	X	Y	S	X	X	ecoMeter	X	ZB*	SP	not available to residents
Onzo	*UK*	X	X	X	X	X	Y	X	Onzo Wireless	Web	ZB**	R, U	only available in UK
P3 International	NY	X	X	Y	X	X	X	Kill-a-Watt	Kill-A-Watt wireless display	X		R	Y
PeoplePower	CA	X	RC	X	X	X	X	X	X	Software, mobile		R	notyet available
Plugwise	*NL*	X	X	Y	X	X	X	Circles	X	Software	ZB	R	Y
PowerHouse Dynamics	MA	Y	X	Y	X	X	Y	Y	eMonitor	Web, mobile	ZB	R	Y
Tendril	CO	Y	X	Y	Y	Y	X	Volt	Insight	Energize application suite	ZB*	U	not available to residents
Tenrehte	NY	X	X	X	X	X	X	PicoWatt	X	Web, mobile		R	not yet available
ThinkEco	NY	X	X	RC	X	X	X	Modlet	X	Web, mobile	ZB**	R	Y

TrickleStar	DE	X	Y	X	X	X	Y	X	Y	X	ZW	U	not available to residents
Visible Energy, Inc	CA	X	Y	Y	X	X	X	Y	UFO Power Center	Mobile		R	Y
Vivint	UT	Y	X	Y	X	X	X	X	Go!Control Panel	Web, mobile	ZW	R	not directly available, and requires monthly subscription
WattsUp?	CO	X	X	X	X	X	Y	Y	Y	Software, web		R, U	Y
WattVision	*US*	X	X	X	X	Y	X	X	X	Web	WiFi	R	Y

KEY
Green - denotes availability
Orange - denotes not immediately available to residential market
X - Not available
? - Availability unknown
Bold – listed in previous report
Italics – country abbreviation (not US state)
C = commercial
R = residential
RC = remote-controlled
S = smart meter required
SP = service providers
U = utilities
ZB = Zigbee
ZW = Z-Wave
*, **, *** = Alliance levels 1, 2 and 3 respectively, where “Alliance” refers to either the Z-Wave or Zigbee Alliance