

**WHY APPLIANCE MANUFACTURERS SHOULD PAY
CLOSE ATTENTION TO PROPOSALS FOR “SMART
GRID” AND
“GRID- FRIENDLY” REQUIREMENTS**

JIM BRUCE

President, J.T. Bruce & Associates

February 2009

A Likely, and Very Early, Element of Smart Grid : “Grid Friendly” Appliance Control Algorithms

- Department of Energy (DOE) tests show small frequency reductions in 60 cycle alternating current (even at 59.5 hz) indicate the electricity grid is stressed and may become unstable causing “brownouts” or “blackouts.”
- DOE tested appliances in 150 homes containing microchips that detect such frequency fluctuations and that respond automatically, turning certain heating elements off temporarily.
- The appliance control algorithm was overridden and only certain heating elements (in clothes dryers and dish washers), not the entire appliance, were turned off. Full appliance operation resumed minutes later with the consumer unaware of the appliance’s partial, instantaneous load shedding.
- Large numbers of such appliances in the residential and commercial sector could act as a grid “shock absorber” to ward off brownouts and blackouts.
- This reduces the need for reserve power plants, and thus will likely have wide support from U.S. policy makers.

Whirlpool Is Probably the Perceived Grid Friendly Appliance Leader

- Whirlpool supplied the grid-friendly appliances with micro chips for the DOE tests.
- In 2006 Whirlpool conducted their own tests to learn if consumers would permit dryers, water heaters, and heat pumps to respond automatically to reduce energy demand.
- See “Consumer ‘White Goods’ in Energy Management,” Gale Horst, Energy Focus Leader, Advanced Electronic Applications Department, Whirlpool Corporation ----
<http://ciee.ucop.edu/dretd/references/documents/whirlpool.pdf>

Other Related Whirlpool Activities

- Consumer focus groups on demand response
- Demonstration of total home energy management system concept
- Standalone Time of Use Appliances that tell consumers when energy prices are high, and permit delay of appliance operation until energy prices are lower.
- Curtailable appliances
- Variable Power Appliances with algorithms that control internal components to avoid power demand peaks -- a range/oven that cycles oven and burners on and off individually to maintain cooking temperatures but limits peak energy demand
- Load leveling of multiple appliances with Home Energy Management concept prototype.
- See: www.pointview.com/data/2008/05/22/pdf/Gale-Horst-3131.pdf

Whirlpool: How Appliances Can Best Save Energy

- Proposals to simply switch residential appliances on/off by remote signals from the electric utility, or from home energy control systems are undesirable.
- White goods perform complex processes on food, clothing, and dishes. Process interruption can pose dangers!
- Only intelligent appliances have algorithms to adjust energy use and yet safely complete the appliance's function.

Whirlpool: Why Forced Interruption of the Appliance's Process Is Unacceptable

- Restart issues (child enters dryer during pause)
- Failed food preservation (refrigeration)
- Incomplete cooking of food, washing of dishes.
- Damage to consumer products (excessive soak time for clothes in detergent additives or bleach.)
- Only the intelligent appliance's algorithm can prevent these problems.
- Neither the electric utility nor the home energy management system can do this.

My Comment: Interference with Consumer Appliance Processes

- Consumers do tolerate appliance process disruptions due to power outages, but blame the electric utility.
- However, with Grid-Friendly appliances, grid instabilities will occur daily, but not necessarily power outages. There will be no apparent problem other than dirty dishes, stained clothes, spoiled food, etc.
- Consumers will blame the appliance manufacturer, not the utility!
- Grid-Friendly appliances must be designed to recover gracefully.

Whirlpool: How Long Before All Appliances Could Become Grid Friendly?

- Annual new appliance sales represent about 10% of total wattage consumed by all U.S. residential major appliances.
- “[T]his seems to show a potential for reasonably quick implementation of a major energy management program.”

Whirlpool: Financial Considerations

Financial mechanisms to reward manufacturers of grid friendly appliances:

- Consumer Rebate card of \$30, of which manufacturer gets \$20
- Regional annual rebate to the manufacturer based on number of “grid friendly” appliances on the grid
- My comment: Who will pay for this?

Refrigerators Are Also A Likely Grid-Friendly Candidate

- In a test, UK government is giving to consumers 3,000 “intelligent” refrigerators that will sense frequency reductions and reduce power demand. They are free because the user realizes no energy savings. See ---
<http://www.guardian.co.uk/environment/2008/dec/02/energy-efficient-dynamic-demand-fridges>)
- If used nationwide in the UK, would reduce need for carbon emitting base load power generation.

GE is Planning Grid Smart Appliances

- “In the first Quarter of 2009, GE will introduce a suite of "smart" appliances or Energy Management Enabled Appliances. These GE appliances will be enabled to receive a signal from their local utility. The appliances will receive the control message and react based on the appliance's internal programming. It requires no customer interaction.
- Within 10 years, energy management enabled appliances could easily occupy the market space held by Energy Star products today. GE is investing in these appliances today, and - by doing so - will be ready to help consumers use less energy and reduce their utility costs in the future.
- See:
http://www.geconsumerproducts.com/pressroom/press_releases/company/company/GE_Appliance_ManufacturersE_smartappliances.htm

Smart-Grid Has Obama's attention

- “We get a immediate jumpstart to the economy and jobs that are immediately being created on things like a smart grid or working to make our buildings more energy efficient.”

President-elect Obama, news conference announcing environment and energy team, Dec. 15, 2008

Other Smart Grid Efforts By Policy Making Entities

“The Federal Energy Regulatory Commission and the National Association of Regulatory Commissioners have established a smart grid task force committed to study policies to promote smart grid deployment. The Edison Electric Institute, the American Public Power Association and the National Rural Electric Cooperative Association all have newly active groups looking at smart grids to better understand how they apply across their utility members. Generally they all agree with a statement made recently by Steve Specker, the President of the Electric Power Research Institute that “Smart grids represent the biggest opportunity for the utility industry in the next decade”.

(Steven G. Hauser Vice President, GridPoint Inc. Founder and President Emeritus, The GridWise Alliance Before the United States Senate Committee on Energy and Natural Resources December 10, 2008)

Smart Grid Is A Complex, Far-Reaching Vision

- Time of day electric rates necessary for “plug-in hybrid vehicles” to ensure battery recharging occurs at night during off-peak.
- Distributed generation of renewable energy sources
- Create market for nocturnal wind power
- “Smart garage” would enable electric grid to tap power from hybrid automobile batteries to meet peak electric demand during the day

Smart Grid Is Controversial and Will Take Years to Implement

- Electric utilities want “decoupling” of their profits from sales of electricity, so they are paid the same even if electric demand drops.
- Electric utilities tried to hold stimulus spending hostage to force states to adopt what looks like decoupling.
- State electric utility regulators disfavor “decoupling” as a one-size fits all policy. See <http://www.naruc.org/News/default.cfm?pr=120>
- Environmental groups favor decoupling as a part of smart grid to reduce carbon emissions.
- Industrials disfavor “decoupling,” fearing higher electric rates, risk-shifting to them, and loss of reward for efficiency.

In Contrast, Congress Could Quickly and Easily Mandate “Grid-Friendly” Appliances

- Easy for Congress to mandate that new appliances contain Grid-Friendly micro chips
- No state regulatory issues are apparent for a simple mandate.
- Could come as part of Energy Star criteria, but would probably require statutory amendment as a grid-friendly appliance is itself probably less efficient than the same appliance without the chip. With the chip, the appliance runs longer to do the same task during a grid event.

Problems for Appliance Manufacturers

- Extra costs: for the chip and to reprogram the control algorithm so as to endure, and gracefully recover from, a grid event.
- Unlike simply improving the appliance's efficiency, Grid friendly appliances yield no cost savings to the appliance owner that aren't available to all electricity consumers (free ride problem)
- If grid friendly appliances prevent blackouts, but do not recover gracefully from grid events, then the appliance manufacturer, not the electric utility, takes the risk and blame.
- Real beneficiary is the electricity utility who shifts this risk and who avoids cost of running standby power plants. All consumers benefit equally but costs are not distributed equally.
- What economic incentive is there for a consumer to purchase a grid friendly appliance?

How Can the Appliance Manufacturer Recoup Costs?

- Federal government unlikely to mandate that state utilities will ensure consumer or manufacturer cost recovery, as this is a retail electric issue traditionally reserved to the states under the Federal Power Act.
- Tax credits for efficient appliances have favored domestic production.
- Other approaches?

Suggestions to Appliance Manufacturers Regarding Grid

Friendly Appliances

- Confirm the premise that small drops in alternating current frequency indicate grid stress and potential grid instability that appliance response can alleviate.
- Anticipate Grid-Friendly mandates or Energy Star requirements
- Explore modifying appliance algorithms to incorporate appropriate Grid-Friendliness in all of them
- Find ways to compensate manufacturer or consumers for grid-friendly appliances (tax credits?)
- Treat as a competitive opportunity, not a burden
- Can such a grid-friendly appliance work globally?

More Suggestions to Appliance Manufacturers Regarding Grid Friendliness

- Ensure that appliance manufacturers are well represented in any in Grid-Friendly policy discussions
 - Energy Star
 - Energy efficiency regulations
 - Tax credits for Grid-Friendly appliances
- Participate in Smart Grid policy negotiations that include Grid friendliness as an objective.

Suggestions Regarding Smart Grid

- Protect appliance manufacturer's exclusive control over the appliance algorithm.
- Insist (via AHAM?) that Smart Grid will only present energy prices and possibly energy demand requests, not commands, to home appliances.
- Anticipate and defend against electric utilities trying to control energy response in appliances as part of "decoupling" in Smart Grid.

Do Appliance Manufacturers Need Utilities to Incorporate Appliances into Smart Grid?

- Assume States adopt time-of-day electric rates
- Assume utilities required to post their day-ahead or real-time electricity costs on the internet.
- Can't appliances monitor those electricity costs and control the appliance's energy use to avoid or anticipate peak electricity costs?
- Can't appliances communicate with each other via home networking?

The Bottom Line

- Grid friendly appliances are quite attractive to policy makers and are not tied to “decoupling” of electric utility rates and other thorny issues of Smart Grid.
- Grid friendliness likely to happen, but the question is, how will appliance makers be compensated, if at all?
- Smart Grid is a longer term opportunity