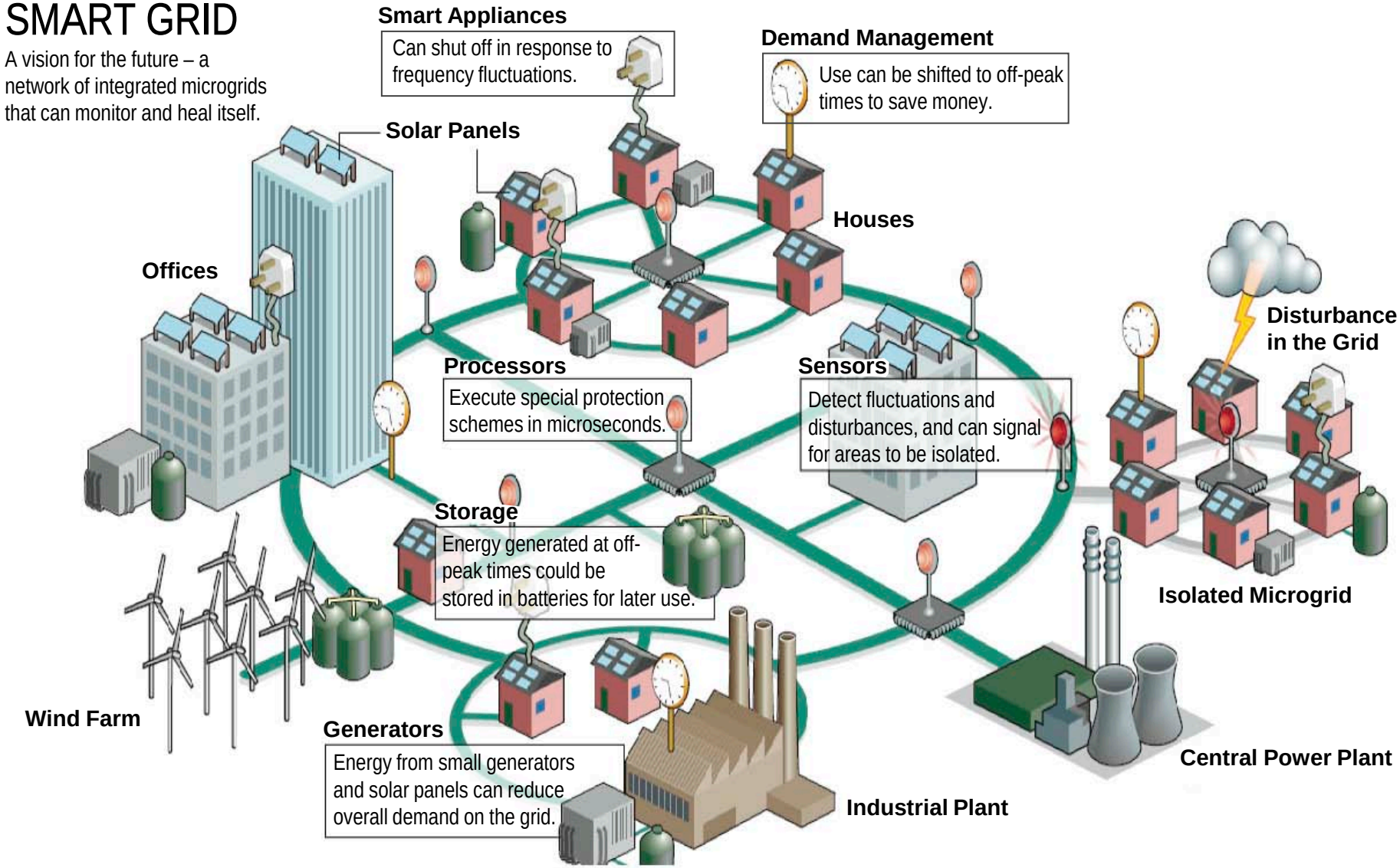
Smart Grid Consumer Benefits: Opportunities and Issues

Kurt Yeager
www.galvinpower.org

USEA Technology Series Briefing — May 18, 2010

Enable the Future

Integrate microgrids, diverse generation and storage resources into a smart self-healing grid system



Source: Interview with Massoud Amin, "Upgrading the grid," *Nature*, vol. 454, pp. 570-573, 30 July 2008

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Unlocking Smart Grid Benefits Requires . . .

- Intelligent technology
- Intelligent policy
- Empowered consumers

We need national leadership for a "plug-and-play" grid, not incompatible islands of non-compliant infrastructure

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Smart Grid Policy Implications

- **A Smart Grid is a *transactive* network, seamlessly connecting producers and consumers.**
- **Price-responsive end-use devices enable autonomous consumer control: *empowerment.***
- **A Smart Grid requires looking beyond the regulated monopoly business model.**
  - **Enable market-based retail services**
  - **Remove barriers to non-utility technology investments**

The result significantly increases both consumer and producer benefits.

Constraints to Deployment

- Consumer knowledge and behavior
- Dysfunctional building design and construction processes
- Utility and regulatory resistance
- Barriers to entrepreneurial innovation

CONCLUSION: These constraints will be overcome by cost and quality pressures.

U.S. Consumer Awareness

- Aware of how much power they use 57%
- Would cut power use if they could track it 67%
- Want to see and control their power use 75%
- Heard of the “Smart Grid” 33%

Harris Poll — February 2010

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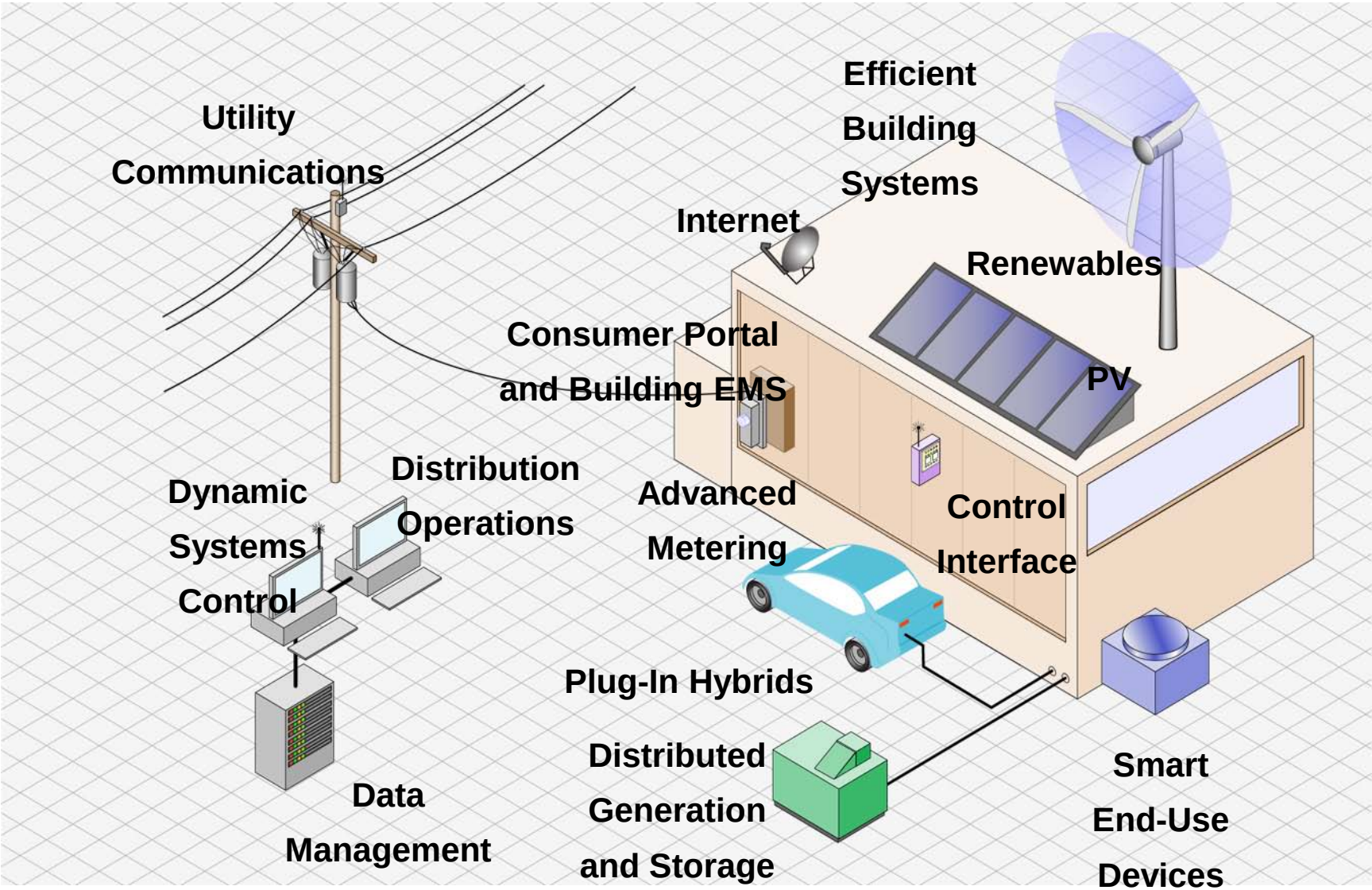
The Microgrid and Its Role in Helping Meet These Challenges



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Community Microgrid Leadership Examples

- Austin, TX
- Naperville, IL
- Leesburg, FL
- Cheyenne, WY
- Ft. Collins, CO
- San Diego, CA
- New Mexico Smart Green Grid

Microgrid Benefits Per Residential Rate Payer

Category	Net Present Value / Year
1. Electricity consumption savings	$100+
2. Time-of-use savings, shifting peak demand	$75+
3. Improved reliability*	$500+
4. Avoided capacity costs*	$100+
5. Job creation and increased income*	$300+
Annual total benefits	**$1,000+ / Year**
Longer-term potential • Households become electricity suppliers • CO_2 emissions reduction (15¢ / kWh) • Energy and homeland security ** Not recognized in present utility/cost benefit accounting rules.*	 1,000+ 300+ priceless

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Principles of a New Electricity Constitution

- Provide all consumers with time-of-use electricity rates and incentives
- Enable municipalities to access and invest in their electricity distribution infrastructure
- Require fundamentally higher distribution reliability standards
- Eliminate utility restrictions on smart microgrids
- Compensate utilities based on their reliability, efficiency and customer service quality
- Establish truly competitive retail electricity service markets

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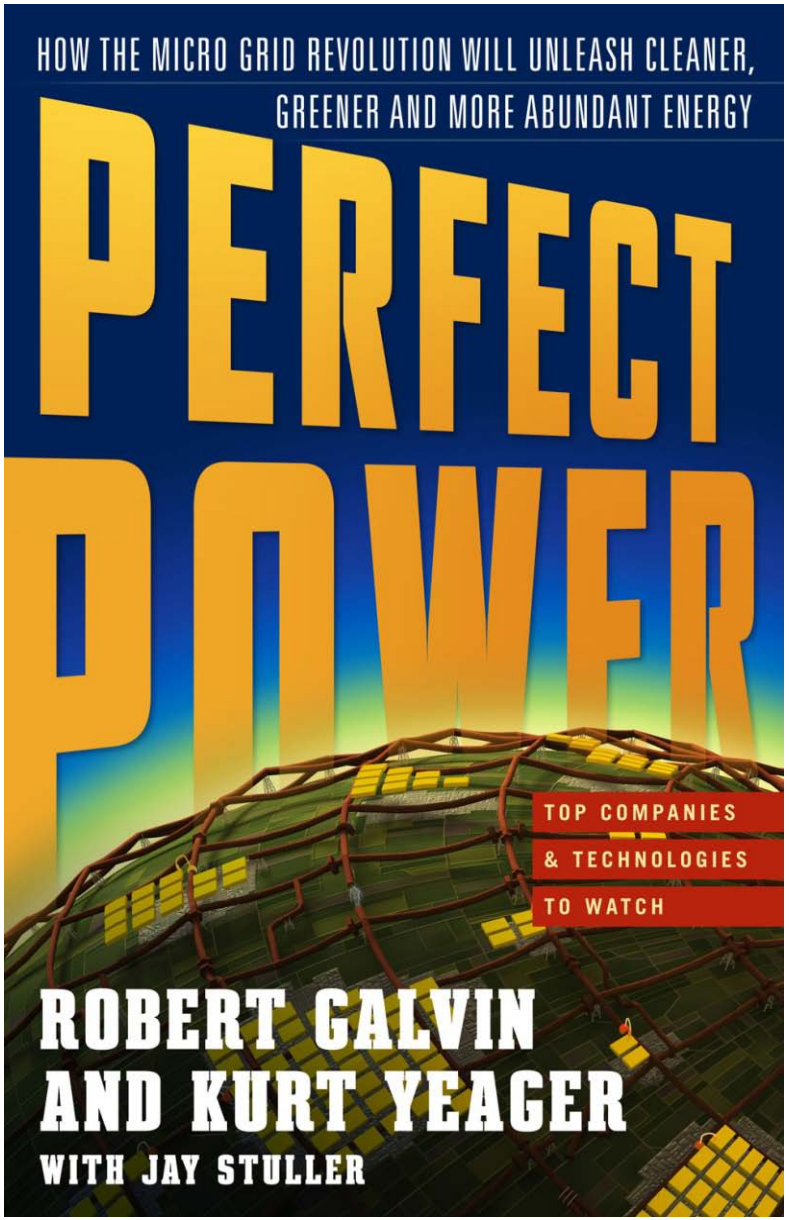
Sponsored by The Galvin Project, Inc.



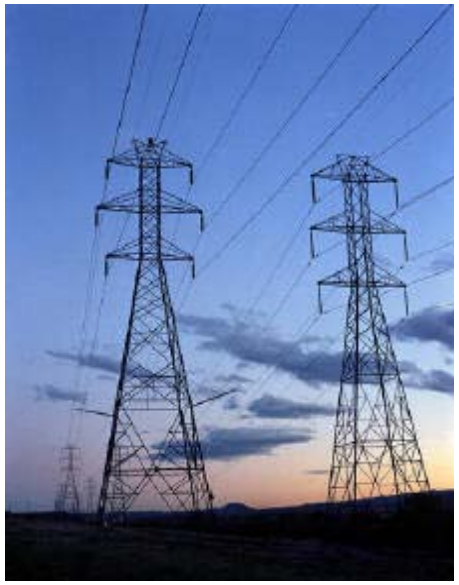
NIST
National Institute of Standards and Technology
U.S. Department of Commerce

Smart Grid from the Consumer Perspective

George W. Arnold, Eng.Sc.D.
National Coordinator for Smart Grid Interoperability
National Institute of Standards and Technology
U.S. Department of Commerce

Smart Grid – A U.S. National Priority

"It is the policy of the United States to support the modernization of the Nation's electricity [system]… to achieve…a Smart Grid." Congress, EISA 2007



"We'll fund a better, smarter electricity grid and train workers to build it…"
President Barack Obama

"To meet the energy challenge and create a 21st century energy economy, we need a 21st century electric grid…" Secretary of Energy Steven Chu

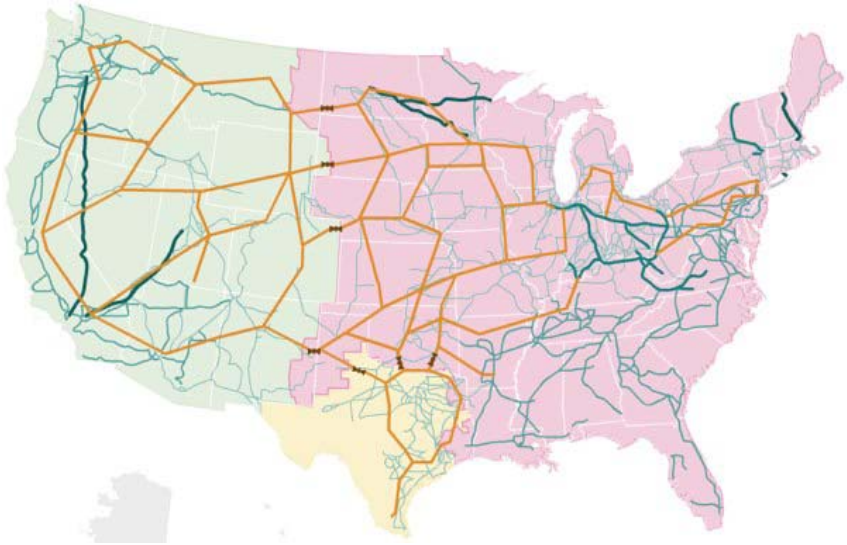
"A smart electricity grid will revolutionize the way we use energy, but we need standards …" Secretary of Commerce Gary Locke

NIST National Institute of Standards and Technology

Why Do We Need Smart Grids?

Fundamental Drivers

- Climate change
- Energy security
- Lifestyle dependent on electricity
- Jobs



Smart Grid Benefits

- Reduce energy use overall and increase grid efficiency
- Increase use of renewable energy
- Support shift from oil to electric transportation
- Enhance reliability and security of the electric system

Consumer Benefits

- Conservation - Studies show consumers save energy when they are aware of consumption
- Efficiency - Smart appliances, with time of use pricing, can shift usage to non-peak periods and reduce need for costly idle generation and transmission capacity
- Reliability - Grid automation can significantly reduce outages (US currently 160 minutes/year vs. 16 minutes/year in Japan)
- Self-generation – using renewable sources such as roof top solar, wind, …
- Electric vehicles – “fuel” cost 2.8 cents/mile vs. 8 cents/mile for gasoline (but offset by higher vehicle cost); reduced dependence on foreign oil

Capabilities enabled by interoperable standards…

ELECTRONIC HOUSE

Whirlpool Aims for Smart Appliances in 2011

Smart appliances will need home control systems to store user preferences.

May. 12, 2010 — by Steven Castle

Whirlpool says by 2011 it will have "smart" appliances that can connect to smart meters and the smart grid.

Whirlpool representatives at the Alliance to Save Energy's EE (Energy Efficiency) Global Forum in Washington, D.C. say the company will have its Energy Smart water heater, with an external hookup for connection to a smart meter, available by the end of 2010.

The company also says smart laundry appliances will be available in 2011.

Whirlpool will release smart laundry appliances in 2011.

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GE's smart grid kitchen of the future

1 2 3 4 ...

NIST National Institute of Standards and Technology

Introducing Chevrolet Volt

Electricity that goes further.

Arriving at the end of 2010. Actual production model will vary.

SEE INSIDE

features + specifications

Price

Nissan LEAF™

100% electric. 0 emissions*

as low as $25,280 net, after tax savings

MSRP $32,780, with federal tax savings from 0 to $7500

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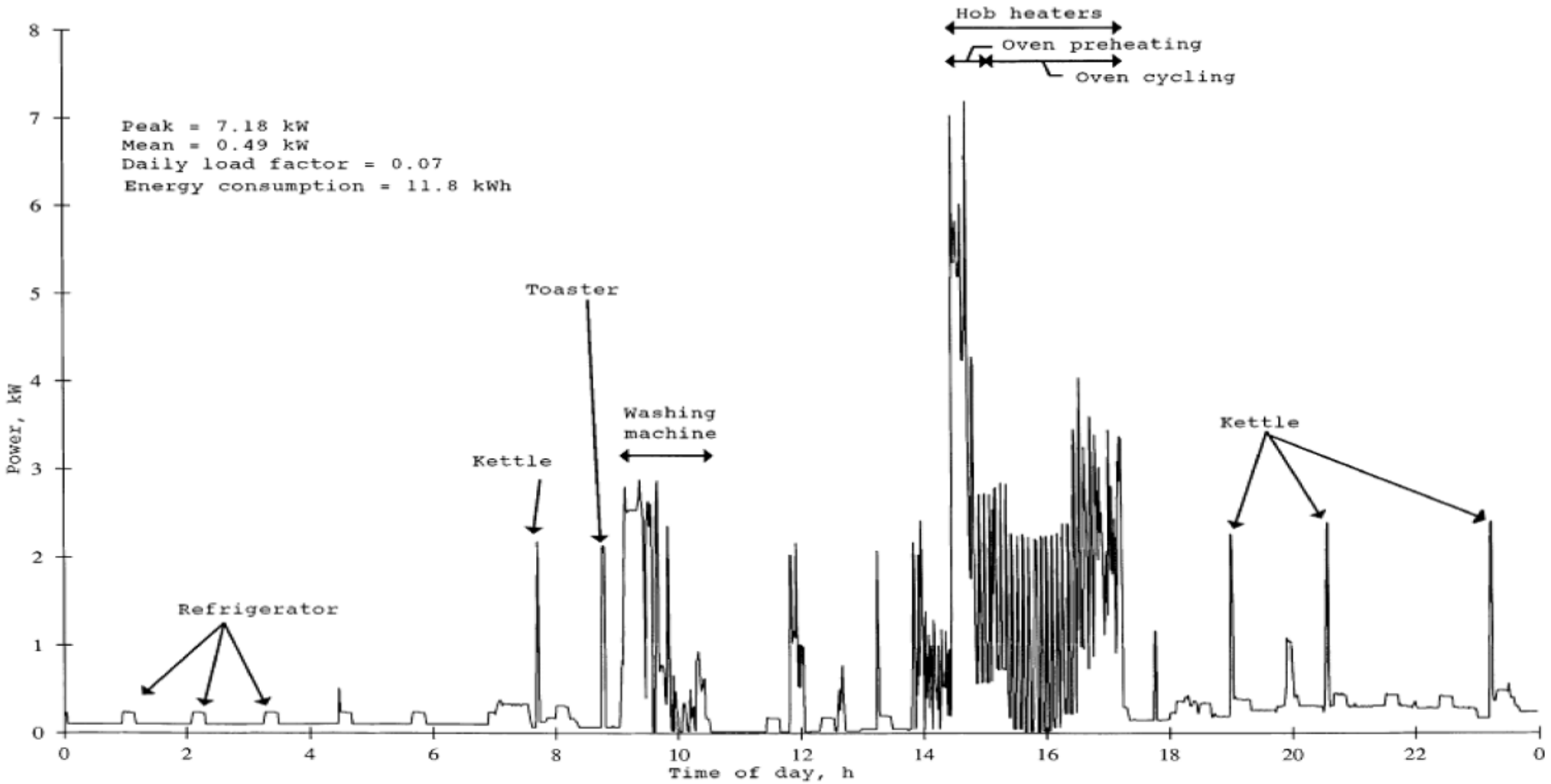
Privacy: an Important Security Aspect



G. Wood & M. Newborough, *Dynamic Energy-consumption Indicators for Domestic Appliances: Environment, Behavior, and Design*, 35 ENERGY AND BUILDINGS 821, 822 (2003).

Office of Science and Technology Policy Forum: Consumer Interface with the Smart Grid Blog

- Sponsored by the White House OSTP
- Open for comment February 23 – March 12, 2010
- Topics discussed:
  - Interface to the smart grid: is the meter the only gateway?
  - Data access, ownership and privacy
  - Communications standards
- Blog received 5000 views, comments posted by 104 individuals and organizations

Summary of Views

- Smart meter should be one, but not the only gateway between the home network and the smart grid
- Communications standards are needed but must allow flexibility and customer choice
- Consumers should have right to access real time meter data
- Consumers should have choice among competitive offerings for energy management services
- Data privacy and integrity must be ensured
- Who pays? AMI should be socialized through the rate base, home network by consumer (possibly through third party service provider), with subsidies for low-income consumers

SMART GRID CONSUMER COLLABORATIVE

USEA Technology Series: How Consumers Benefit from the Smart Grid

Katherine Hamilton

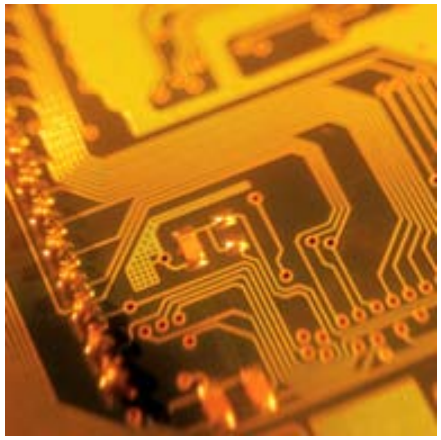
May 18, 2010

GRIDWISE ALLIANCE

BENEFITS OF SMART GRID: CONSUMER

- Greater consumer choice and control
- Increased information to consumer
- Reduced cost through efficiency
- Engagement in new technologies
- Environmental value
- Increased safety and privacy
- Economic growth and cleantech jobs

Benefits of Smart Grid



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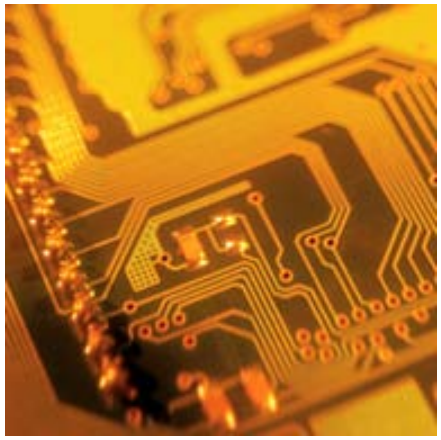
DO CONSUMERS BELIEVE THIS?

Pitchfork-wielding mobs encircle smart meters

'Fraud meter' fear

By Dan Goodin • Posted in Science, 27th November 2009 22:02 GMT

A push by California's electricity provider to modernize its power grid is turning into a public relations disaster, as allegations mount that it's responsible for stratospheric overcharges.



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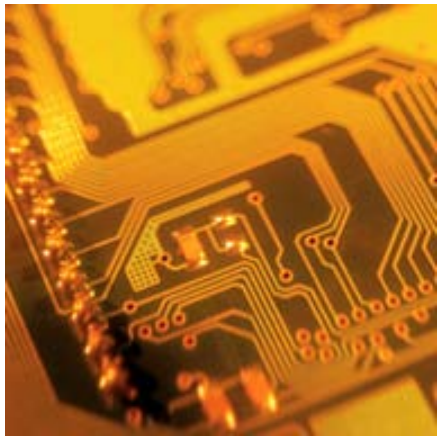
SURVEY BY IBM

Almost 70 percent of 5000 respondents expressed willingness to experiment with how they interact with energy providers and would take advantage of partnership different from traditional utility-customer relationship.

Source: Lighting the Way: Understanding the Smart Energy Consumer; 2008 Global Utility Consumer Survey



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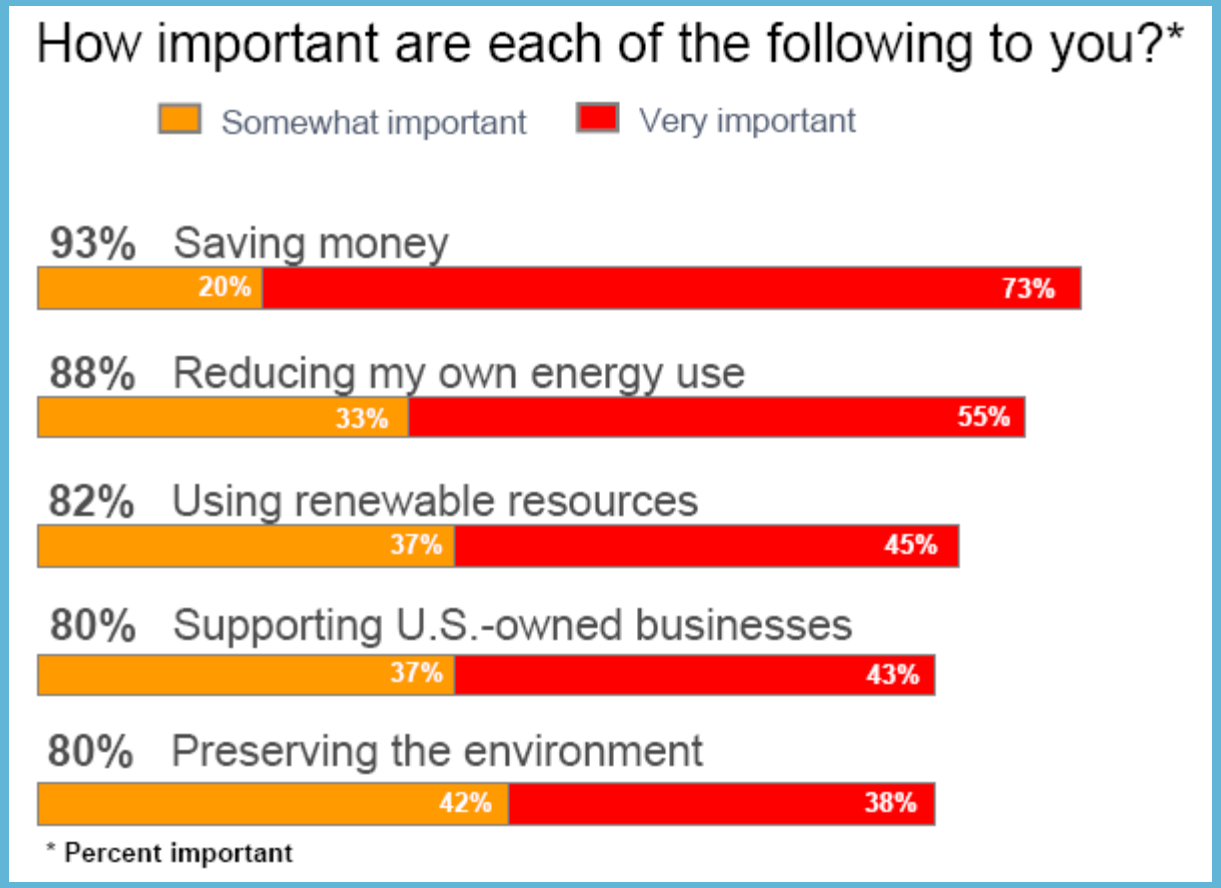
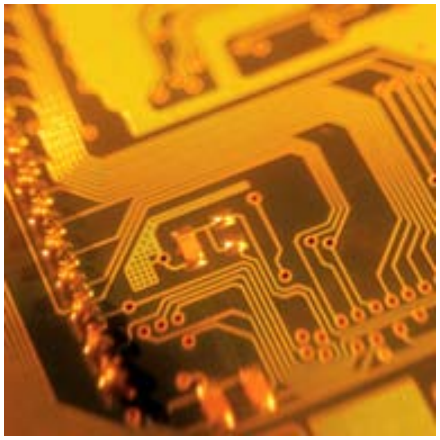
ON ONE HAND…





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ON THE OTHER HAND…

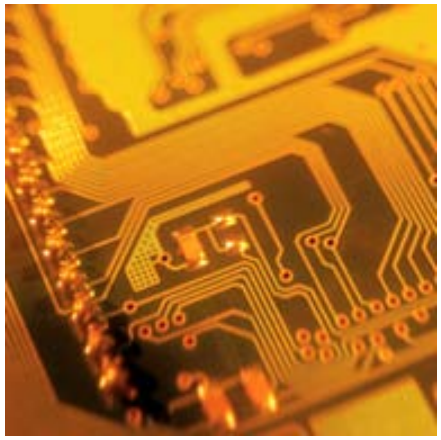
Only 20% said they would pay an upfront fee to view a detailed, real time energy consumption report.

Only 14% gave utility “A” grade on “current ability to provide detailed, useful information on energy consumption”.

Only 6% of respondents have installed some type of renewable energy source in the last 12 months.

While 58% utilities surveyed offer net metering programs – allowing homeowners to generate and sell back to the utility own renewable energy –only 11% say their customers are active in those programs.

Source: Oracle, Turning Information Into Power Moving Toward the Smart Grid, 2009



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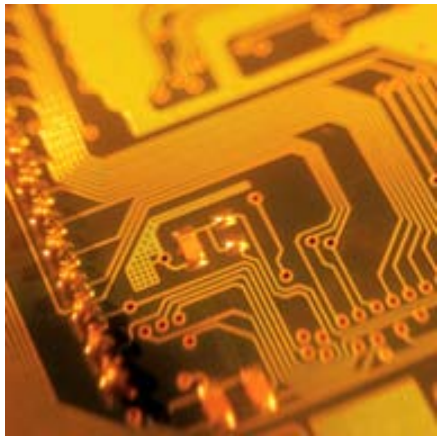
DO CONSUMERS KNOW ABOUT SMART GRID?

79% of U.S. consumers polled are not familiar with the term “smart grid.”

4% said they have heard of a smart grid and have a good understanding of what it is.

80% who are familiar with smart grid wish they knew more about how it affects them.

Source: GE Smart Grid Survey, March 2010



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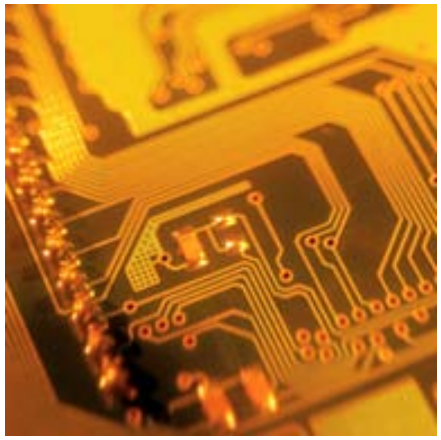
AND YET THEY HAVE EXPECTATIONS

96% think smart grid offers benefits

80% excited about upgrading the electrical network so that our country can rely more on clean domestic energy sources (80%)

78% believe smart grid would help reduce the number of power outages and restore power more quickly

Source: GE Smart Grid Survey, March 2010



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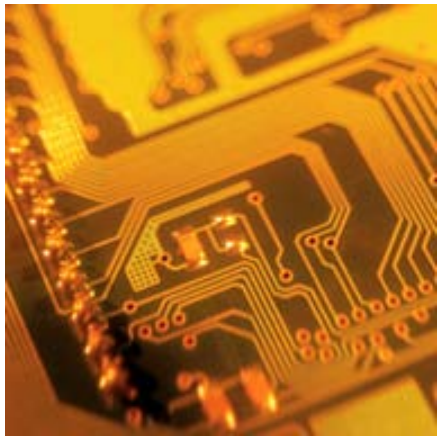
AND SAY THEY WOULD BE WILLING TO CHANGE BEHAVIOR

75% who understand smart grid would participate in a TOU rate if they could save money by shifting or reducing daytime energy usage

66% say they would buy smart appliances and other in-home devices to maximize their control over energy once smart grid installed

Source: GE Smart Grid Survey, March 2010



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WHAT DO THEY REALLY DO?

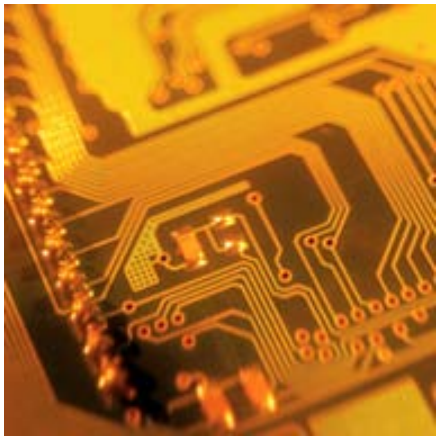
Customers respond emphatically to pricing signals, reducing consumption by ¼ to 1/3

Average customer savings was $115 over the summer months

More than 98% reduced their bills, all socio-demographic groups

Customer satisfaction was 92% - 99%

Source: Baltimore Gas and Electric PEAKRewards Program, 2009



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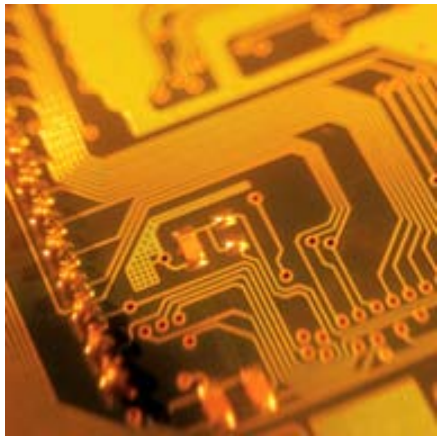
THERE IS MORE WORK TO DO!

Smart Grid Consumer Collaborative

Suppliers, vendors, utilities, consumer advocates, utility commissioners collaborating to further modernization of electric infrastructure.

Create a consumer-friendly, consumer-safe smart grid.



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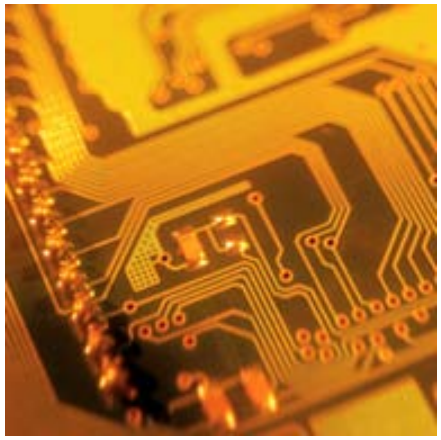
MISSION OF SGCC

- **Listen** to consumers needs and priorities
- **Educate** consumers about smart grid basics and benefits
- **Collaborate** with all organizations to share best practices



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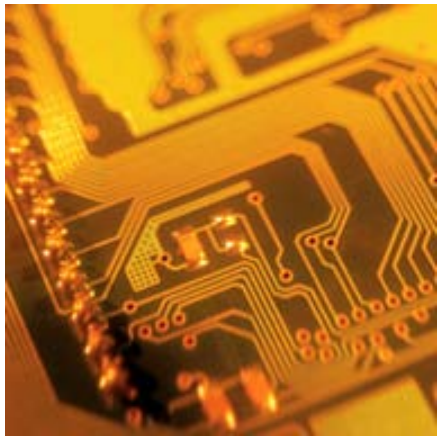
ACTIVITIES OF SGCC

Field broad-scale consumer research this summer for qualitative and quantitative insights into consumer behavior and understanding of smart grid adoption.

Create knowledge base of best practices and lessons learned.

Host SGCC Summit in September as part of GridWise Global Forum.



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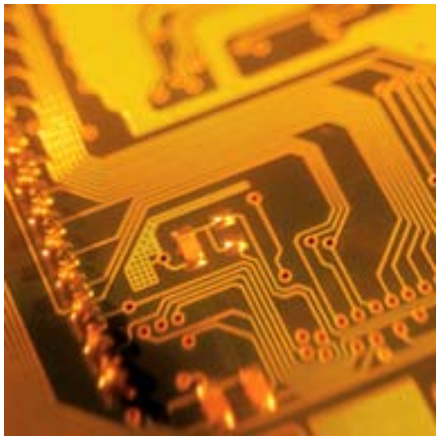
SMARTGRIDCC.ORG

SmartGrid consumer collaborative



GRIDWISE ALLIANCE

Focus on Results

- What specific outcomes will a smart grid project produce?
  - Cost
  - Reliability/safety
  - Environment
  - Conservation
- Performance metrics provide evidence that smart grid goals are being attained
- DOE is researching smart grid performance and “build” metrics
- The Galvin Electricity Initiative is in the early stages of developing a performance metric rating system leveraging the LEED approach

Possible Consumer-Driven Performance Metrics

- Safety/reliability
- Cost transparency
- Cost and price responsiveness
- Efficient use of capital
- Efficiency
- Innovation
- Environment
- Aesthetics
- Technology ready
- Consumer empowerment
- Value customer participation