# Smart Appliances and their Impact on Energy Usage


**Charlie Smith**

**GE Appliances & Lighting**

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# AHAM Smart Grid White Paper from December 2009

## The Home Appliance Industry's Principles & Requirements for Achieving a Widely Accepted Smart Grid

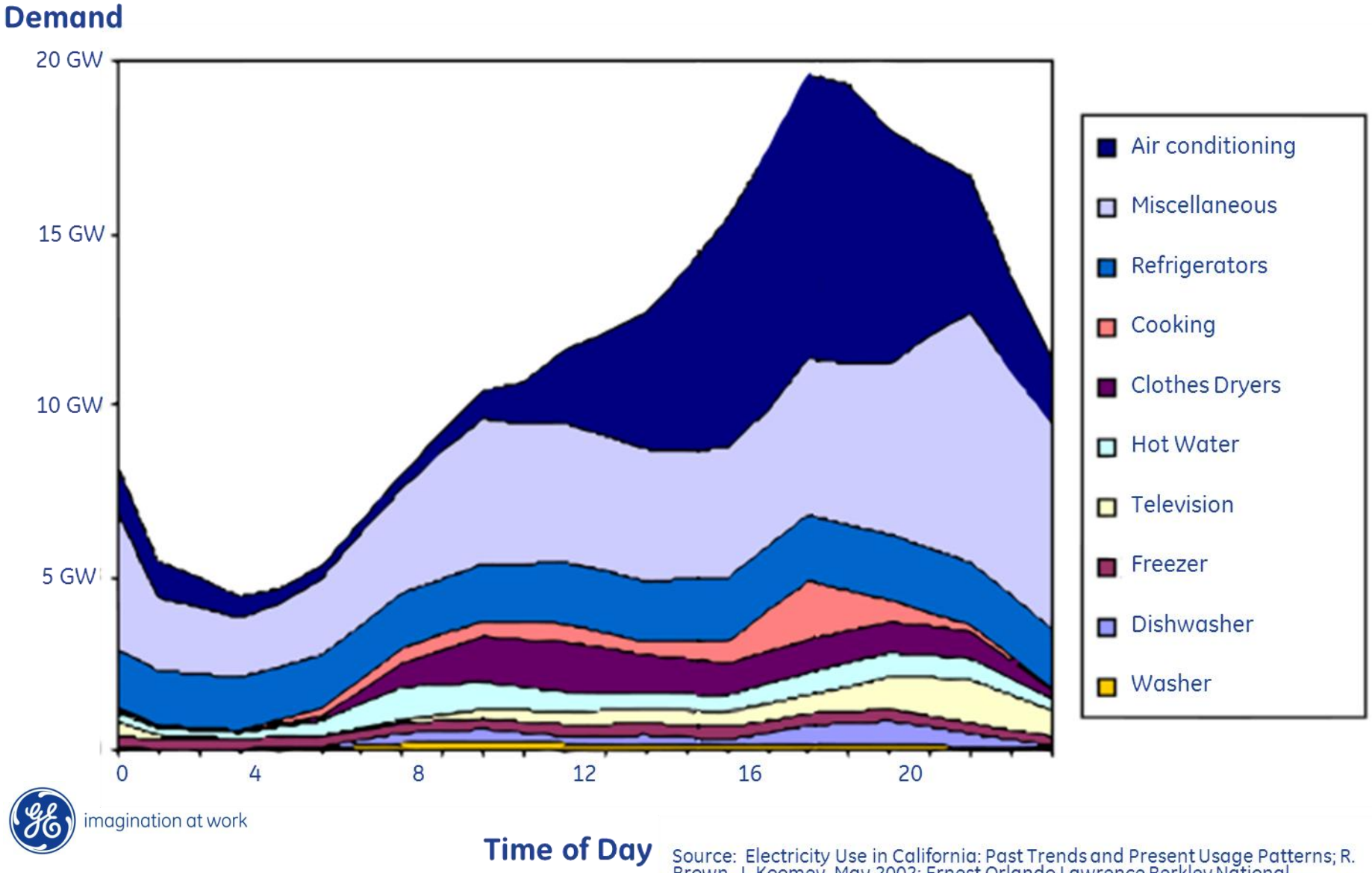
### Essential Requirements

1. **Pricing** must provide incentives to manage energy use more efficiently and enable consumers to save money.
2. **Communication Standards** must be open, flexible, secure, and limited in number.
3. **Consumer Choice & Privacy** must be respected; the consumer is the decision maker.

http://www.aham.org/ht/a/GetDocumentAction/i/44191

# Market Drivers… Consumer Demand

## Residential Summer Loads – California

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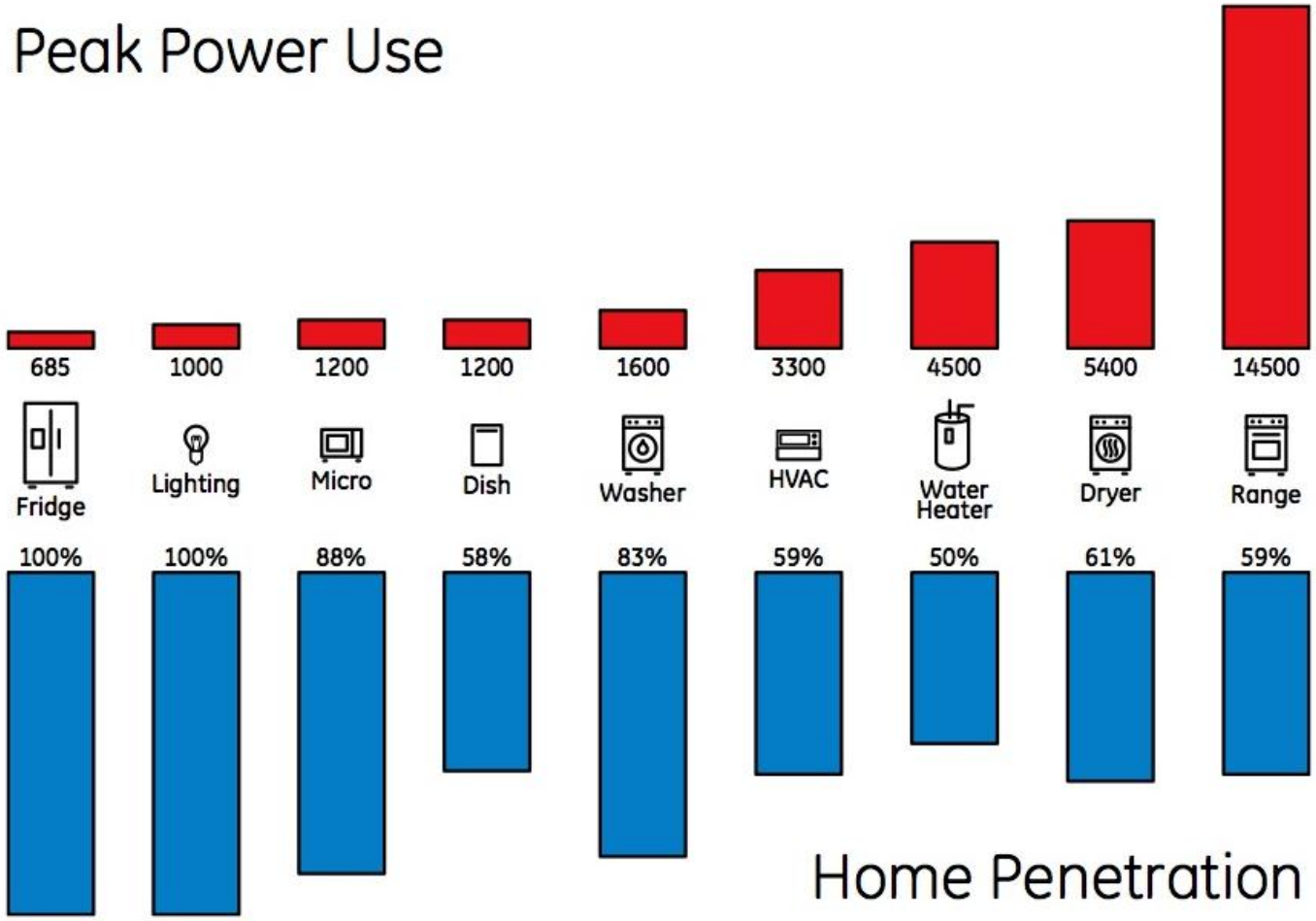
Source: Electricity Use in California: Past Trends and Present Usage Patterns; R. Brown, J. Koomey, May 2002; Ernest Orlando Lawrence Berkley National Laboratory, 2002

# Peak Potentials




*Source: EIA, AER 2007.*

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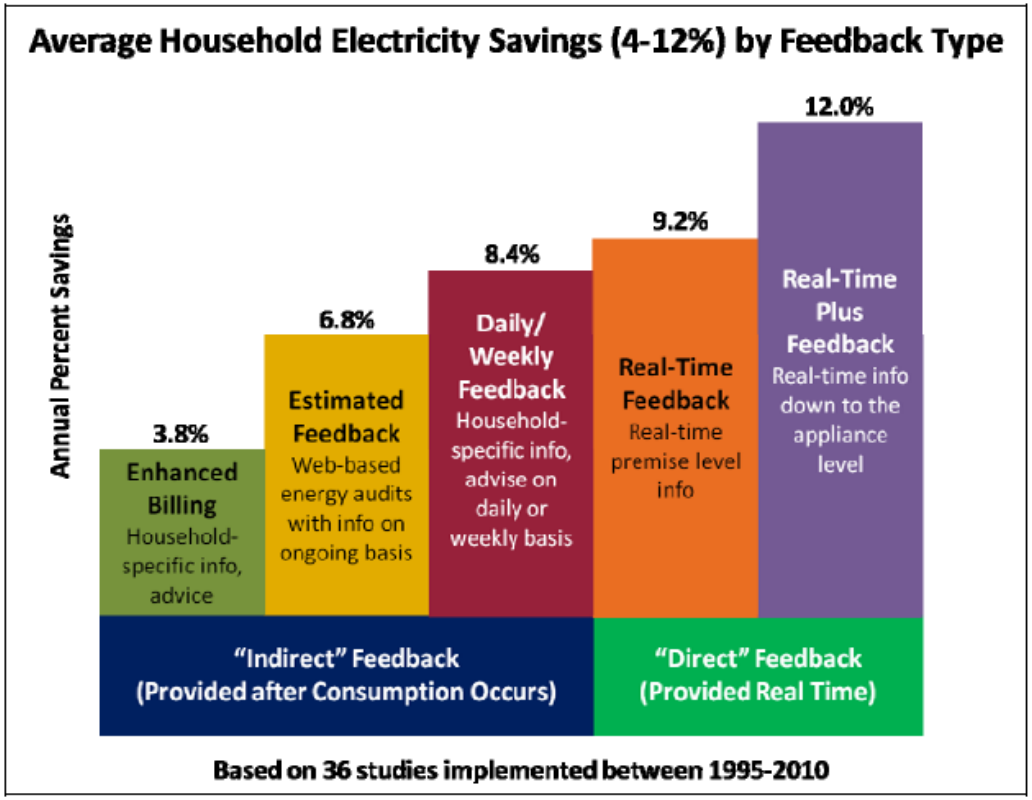
# June 2010 ACEEE Report

Advanced Metering Initiatives and Residential Feedback Programs




"…feedback programs for the residential sector might generate electricity savings that range from as little as 0.4% to more than 6% of total residential electricity consumption."

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LINK http://www.aceee.org/research-report/e105

# Feedback Application

# Smart Phone Application


## *Resources*


## *Appliances*


## *Thermostat*


Adjust programmable thermostat


## *History*


Prototype


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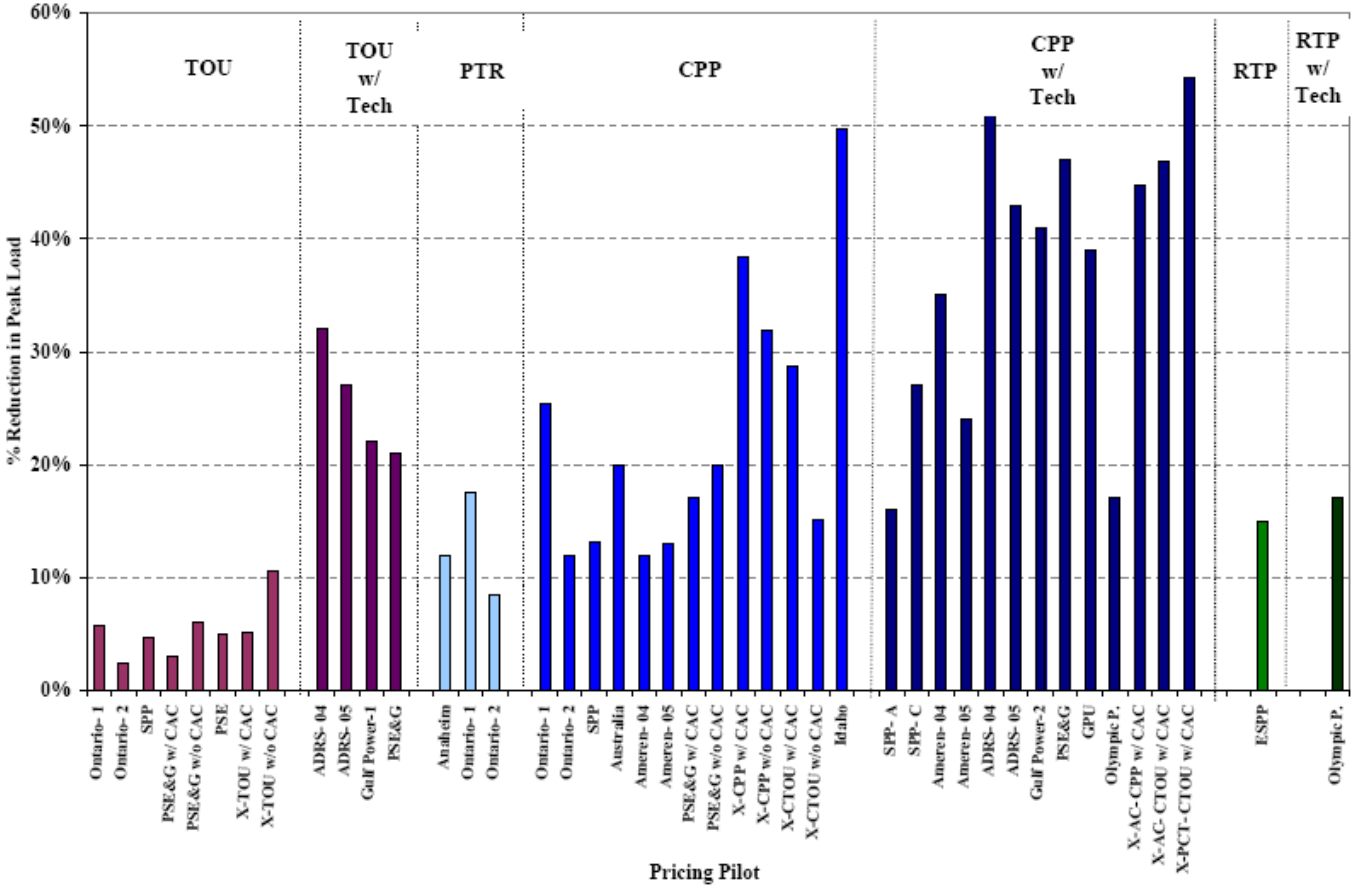
# HOUSEHOLD RESPONSE TO DYNAMIC PRICING OF ELECTRICITY

**SURVEY OF THE EXPERIMENTAL EVIDENCE**

**Ahmad Faruqui and Sanem Sergici1**

**January 10, 2009**

**Figure 1:**




http://www.brattle.com/Experts/ExpertDetail.asp?ExpertID=164

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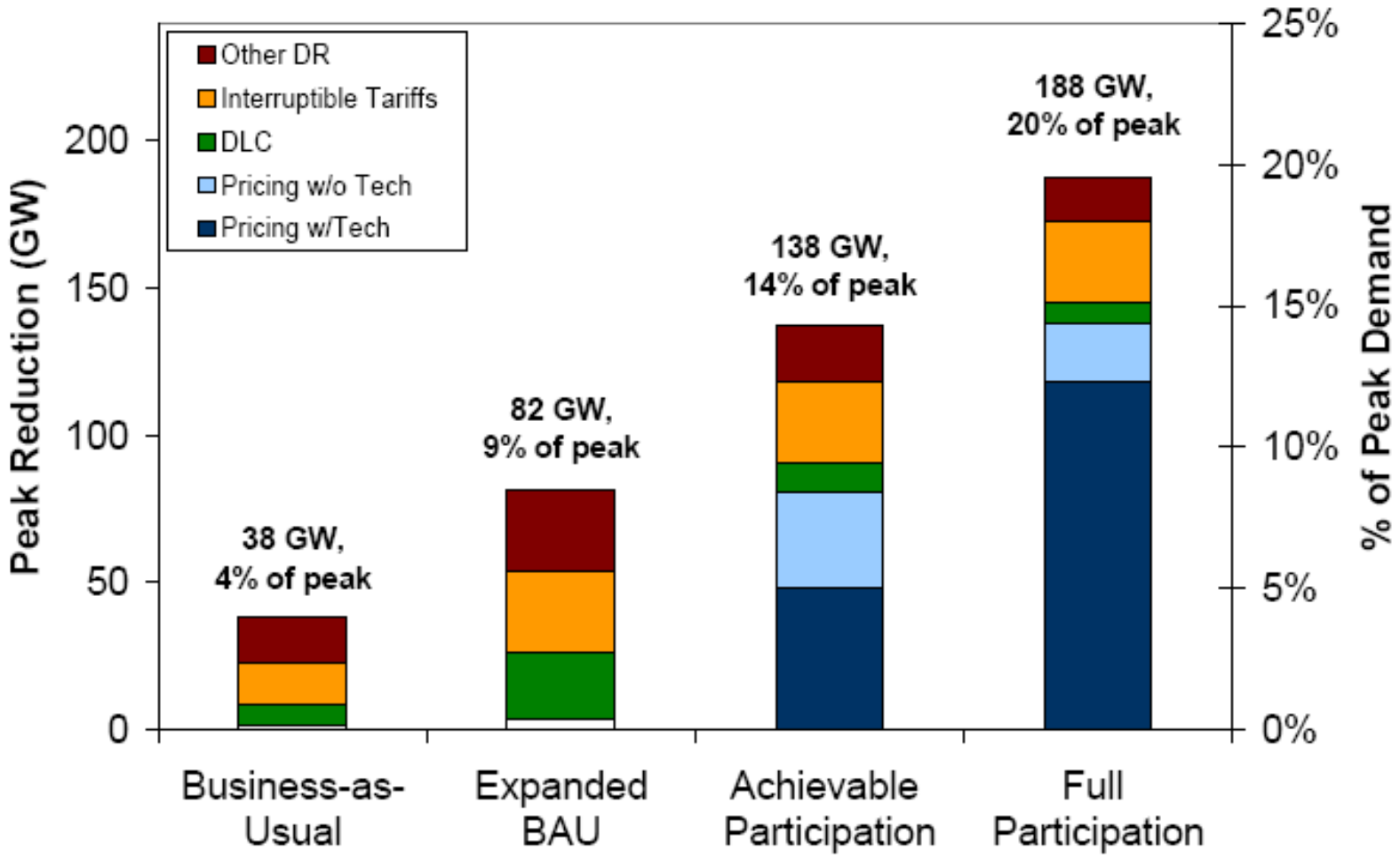
# A NATIONAL ASSESSMENT OF DEMAND RESPONSE POTENTIAL

## FERC, June 2009

Figure 2: U.S Demand Response Potential by Program Type (2019)




http://www.ferc.gov/legal/staff-reports/06-09-demand-response.pdf

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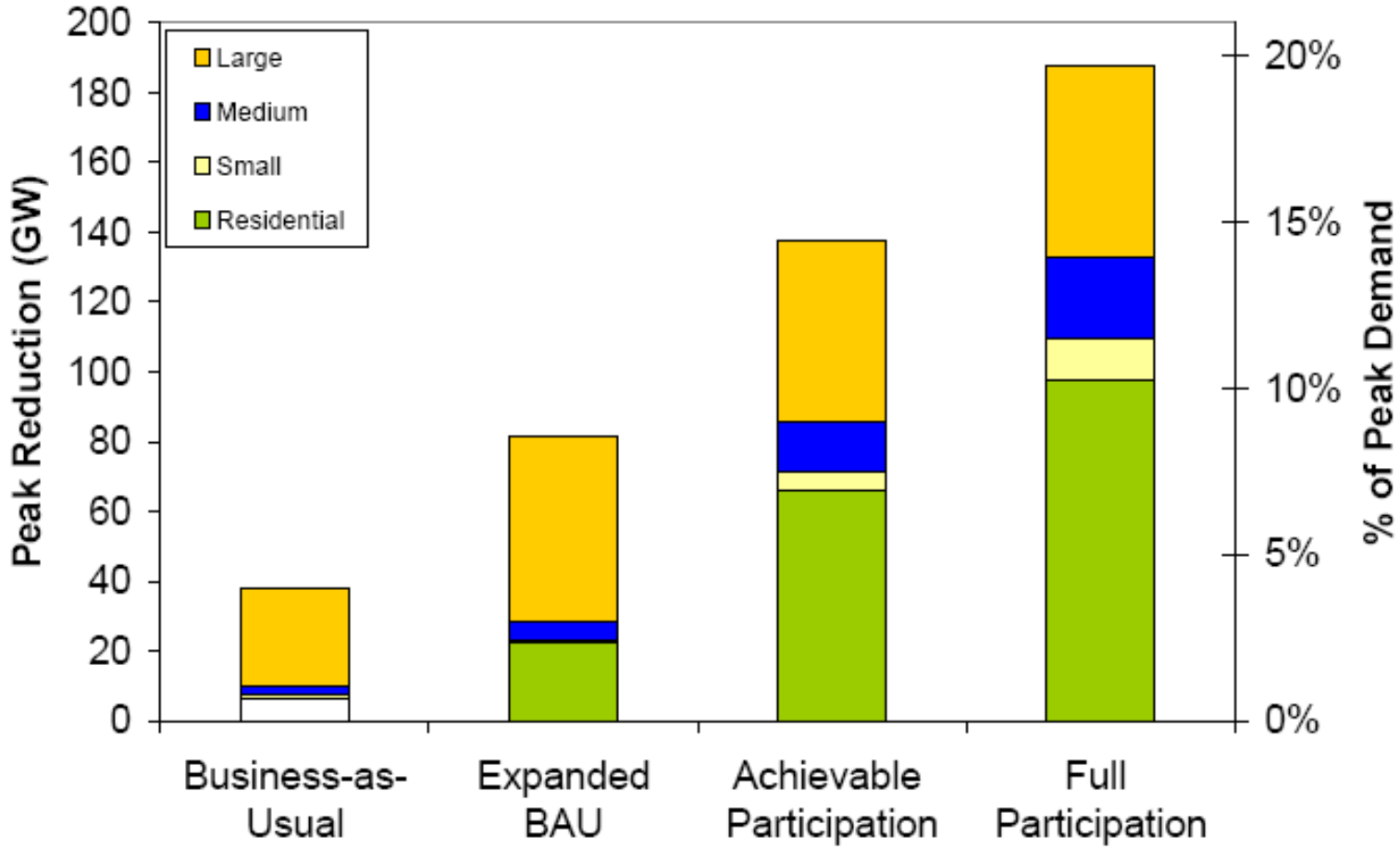
# A NATIONAL ASSESSMENT OF DEMAND RESPONSE POTENTIAL

## FERC, June 2009

Residential homes offer as much demand response *potential* as small, medium and large businesses combined…. FERC

Figure 3: U.S. Demand Response Potential by Class (2019)




http://www.ferc.gov/legal/staff-reports/06-09-demand-response.pdf

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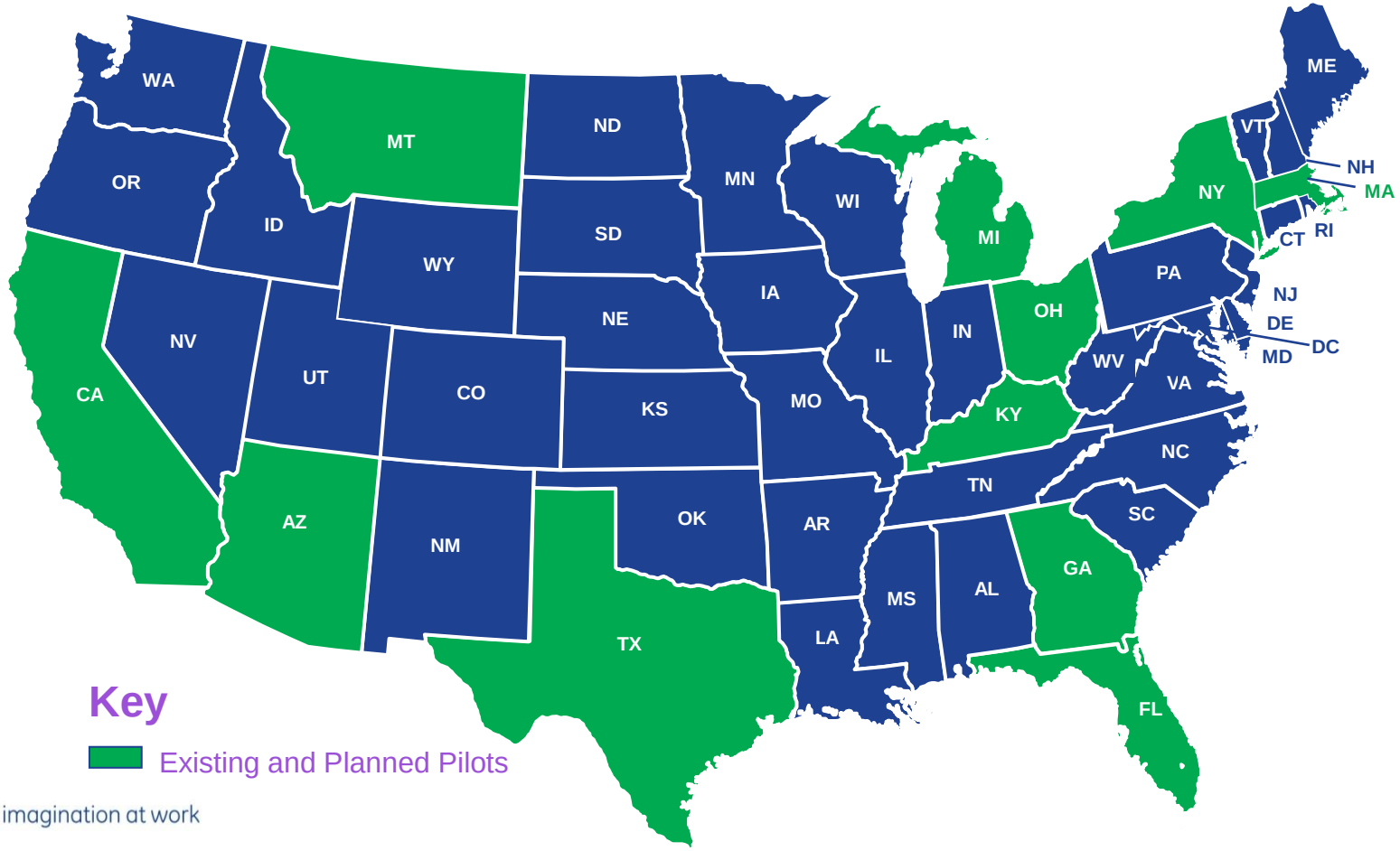
# Pilot Programs

GE has been working with utility partners to better understand consumer acceptance and issues with smart appliances

Utility pilots encompass IOU's, Cooperatives, and Municipals in sizes ranging from a few homes to over a 1,000.

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# Demonstrated benefits

Peak time kW reduction per home

| | T-stat, Load Ctrl[-2] | Smart Appliances |
|---|---|---|
| 1st hour | 1.0 | 1.8 |
| 2nd hour | 0.9 | 1.6 |
| 3rd hour | 0.6 | 1.0 |
| 4th hour | 0.6 | 1.3 |
| 5th hour | (0.4) | (0.1) |

***Smart appliances nearly double benefit***

2) Load control device installed on water heater

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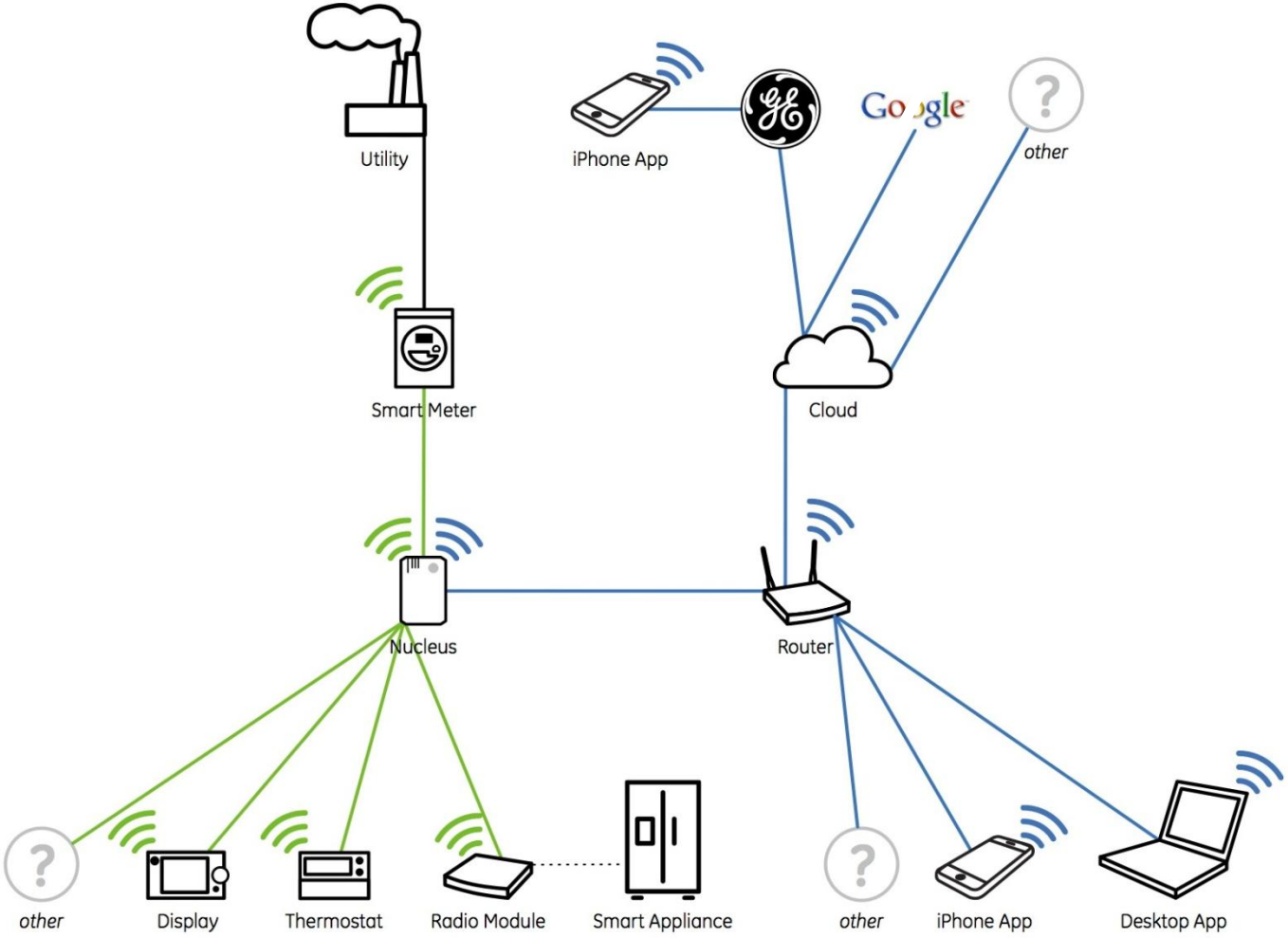
http://psc.ky.gov/pscscf/post%20case%20referenced%20correspondence/2007%20cases/2007-00117/20110701_LGEs%20Evaluation%20of%20Responsive%20Pricing%20and%20Smart%20Meter%20Pilot%20Program.pdf

# GE Home Energy System

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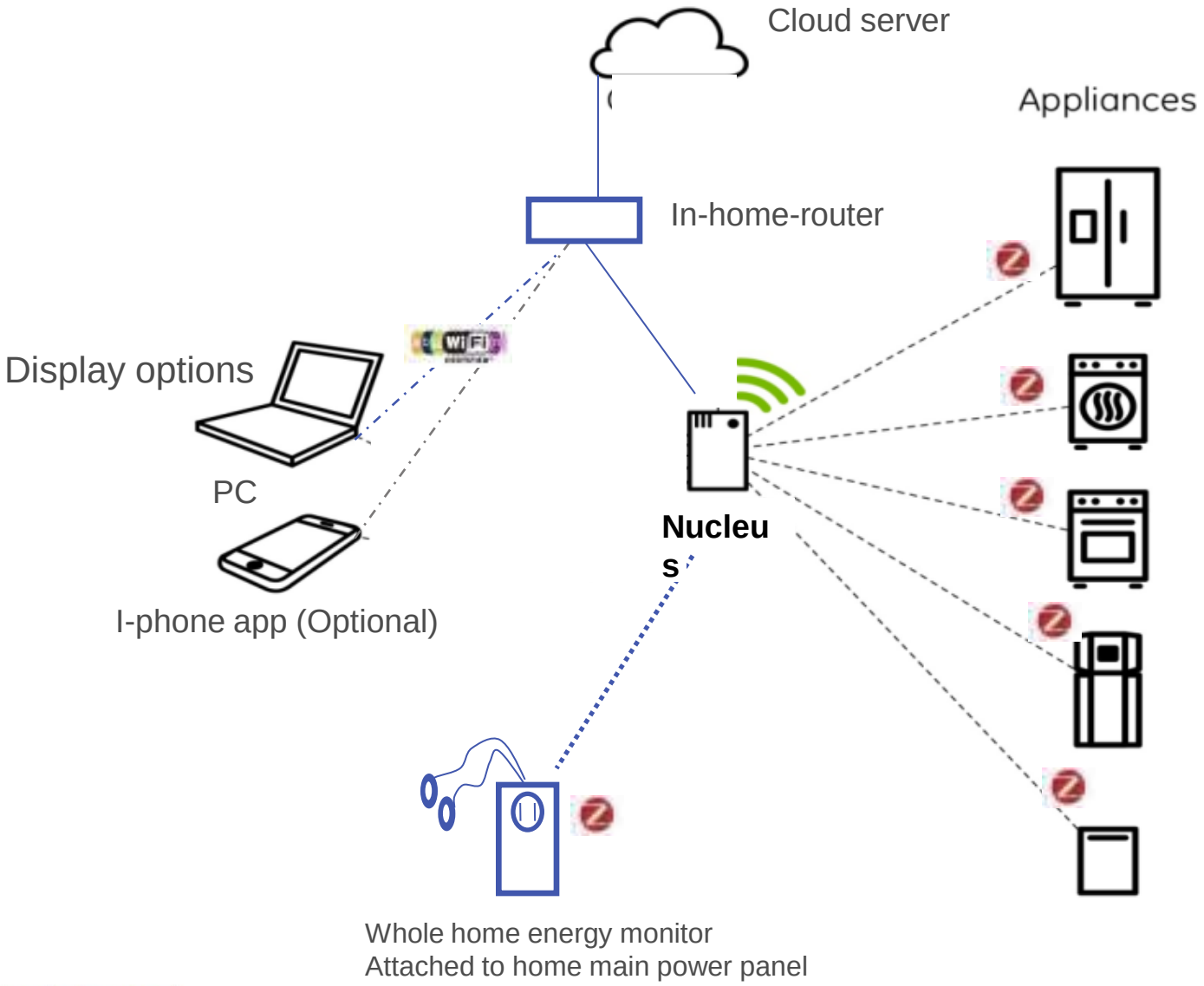
# System Overview – Vineyard

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# Vineyard Power

*Vineyard Energy Project*


## Abstract

The Vineyard Energy Project involves the deployment of customer systems to enable real-time load measurement and management while helping customers optimize their electricity usage. The main objective is to assess the effectiveness and customer acceptance of the technologies and determine the extent to which they can help accommodate greater penetration of wind energy. Home area networks, energy management systems, direct control devices (including water heaters, air conditioners, and water pumps), and various smart appliances are integrated into Vineyard Power Management System (VPMS) (i.e., Vineyard Power's load balancing system). The project also allows participating customers access to a Web portal—allowing them to view their energy usage information and their participation in adjusting the load shape to better match wind generation patterns. A supermarket implementation widely monitors energy use and connects VPMS with a temperature sensor and a load control switch in a refrigeration demand response demonstration responding to the VPMS price signal.


## Smart Grid Features

***Communications infrastructure*** includes Internet-based, two-way communication networks that integrate the operation of customer

**At-A-Glance**

**Recipient:** Vineyard Power

**State:** Massachusetts

**NERC Region:** Northeast Power Coordinating Council

**Total Budget:** $1,574,500

**Federal Share:** $787,250

**Project Type:** Integrated and Crosscutting Systems

**Equipment**

- Customer Systems for 36 Customers
  - Home Area Networks
  - Customer Web Portal
  - Energy Management Systems
  - Direct Load Control Devices
  - Smart Appliances
- One Electric Vehicle Charging Station

**Key Targeted Benefits**

- Reduced Greenhouse Gas and Criteria Pollutant Emissions
- Reduced Electricity Costs for Customers

http://sgstage.nrel.gov/sites/default/files/09-0262-vineyard-power-project-description.pdf

# Thank you