

# Factors Accelerating the Development of the Smart Grid

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## Discussion Outline

- Introduction
- Overview of acceleration factors
  - Utility business case – works for them
  - Regulatory drivers – leveling the playing field
  - Legislative drivers – EISA 2007
  - Consumer advocacy – controlling cost
  - Environmental – green is good
  - Overall cost of energy in all forms – electricity instead of oil
  - Rest of industry – plenty of cool technology to sell
- Perspectives on Architecture
  - AMI as an accelerator for infrastructure deployment
  - End use architectures
- Some of the players – developers of the smart grid

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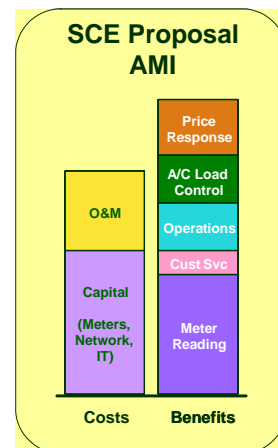
## The Drivers

- Not a comprehensive list
  - Utility operations improvement
  - Regulatory
  - Legislative
  - Consumer advocacy
  - Environmental
  - Overall cost of energy in all forms
  - Technology – because we can
- Changing every day

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## Utility Drivers

- Some are moving forward because they were told to do so
- Many have discovered real value once they started to look at it formally
- Every utility is different
  - BC Hydro - \$30 Million per year in energy theft and growing (pun intended)
  - Other utility of similar size – theft less than \$1 Million per year



SCE Aug., 2005 Supplemental Testimony supporting Phase I

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## Benefit Identification

- Every utility is different
- There are examples from other utilities of numerous benefit opportunities – e.g. California Framework and Value Streams
- A well designed process should be used to identify benefits

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## Empowering Customers



- Rate choices to manage costs
- Energy information and analysis
- Service automation--remote turn-on
- Billing & Payment options
- Communication with SmartGrid technologies to detect, avoid and repair grid problems in seconds



Slide credit: SCE

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## Regulatory and Legislative

- Representing the customer view?
- In some ways, helping define what the smart grid is
  - California Energy Commission Public Interest Research Program
    - » High level architecture for metering, distributed resources, and smart grid
    - » Business case framework
    - » Sensing devices
    - » Actuating devices – PCT and load control devices
  - EISA 2007 – defined by what will be funded

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## What is the Smart Grid? – EISA 2007

- The term Smart Grid Functions shall include:
  - Ability to store, send and receive digital information through a combination of devices
  - Ability to do same to or from a computer or control device
  - Ability to measure and monitor as a function of time of day, power quality, source and type of generation, etc
  - Ability to sense disruptions in power flows and communicate on such instantaneously
  - Ability to detect, respond to, recover, etc relative to security threats
  - Ability of appliances and equipment to respond without human intervention
  - Ability to use digital information for grid operations that were previously electromechanical or manual
  - Ability to use digital controls to manage demand, congestion, and provide ancillary services

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## EISA 2007 Section 1301 – Statement of Policy

National policy to support the modernization of the nation's electricity T&D system ... that can ... achieve each of the following, which together characterize a smart grid:

1. Digital information and controls
2. Dynamic optimization with cyber-security
3. **Deployment and integration of distributed resources and generation, including renewables**
4. **Use of demand response, demand-side resources and EE**
5. Smart technologies for metering, grid communications and distribution automation
6. **Integration of smart appliances and consumer devices**
7. **Advanced storage and peak-shaving technologies, including PHEVs and thermal-storage A/C**
8. Give consumers timely information and control options
9. **Develop standards for communication and interoperability of appliances and equipment connected to the grid, including grid infrastructure**
10. Identify and lower barriers to adoption of smart grid technologies, practices and services

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## Sec 1304 – Technology RD&D

Regional Demonstration Initiative specifically focused on advanced technology for power grid sensing, communications, analysis and power flow control, including:

1. Demonstrate benefits of concentrated investments of SG technology on regional grids
2. Facilitate commercial transition to advanced technologies
3. Facilitate integration of advanced technologies into existing networks
4. Demonstrate protocols and standards for measurement and validation of energy and emissions savings from DR and EE
5. Investigate differences across regions and regulatory environments regarding best practices in implementing SG technologies

**Authorization -- \$100 mil/year, 2008-2012**

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## Sec 1306 – Fed Matching Grants

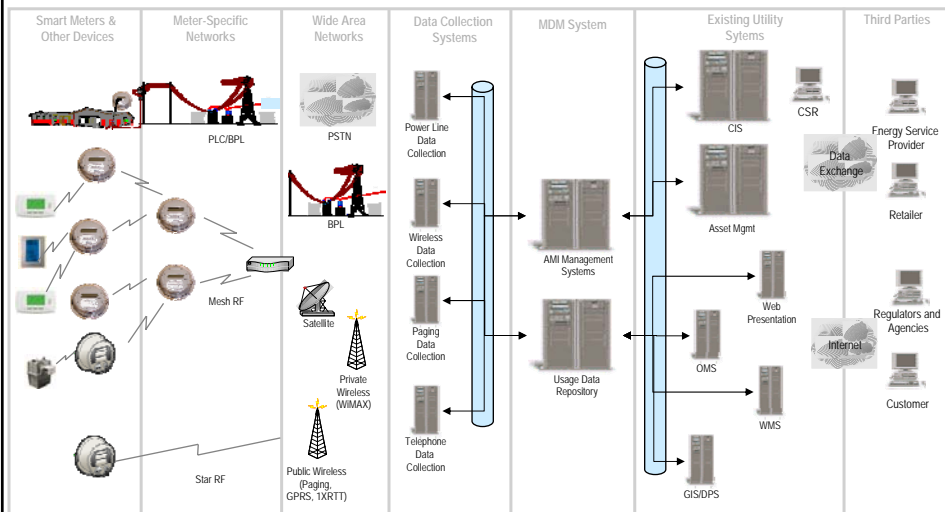
**New DOE program to provide reimbursement of 20% of smart grid investments**

- Procedures published within one year; authorization of such sums as necessary
- Qualifying SG investments
  1. Manufacture of efficient appliances
  2. Modifying special electricity equipment, e.g. motors
  3. Utility installment of SG-enabled T&D infrastructure
  4. Purchase and installation of metering and control devices and equipment
  5. Software to enable computers to engage in smart grid functions
  6. Installation by regional system operator of equipment for coordination among utilities and regions
  7. Non-utility-owned DG
  8. Devices to allow a PHEV to engage in smart grid functions (excluding storage costs)
  9. Costs of buying and implementing other SG functions, especially rewarding innovation and early adaptation

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## AMI System Architecture

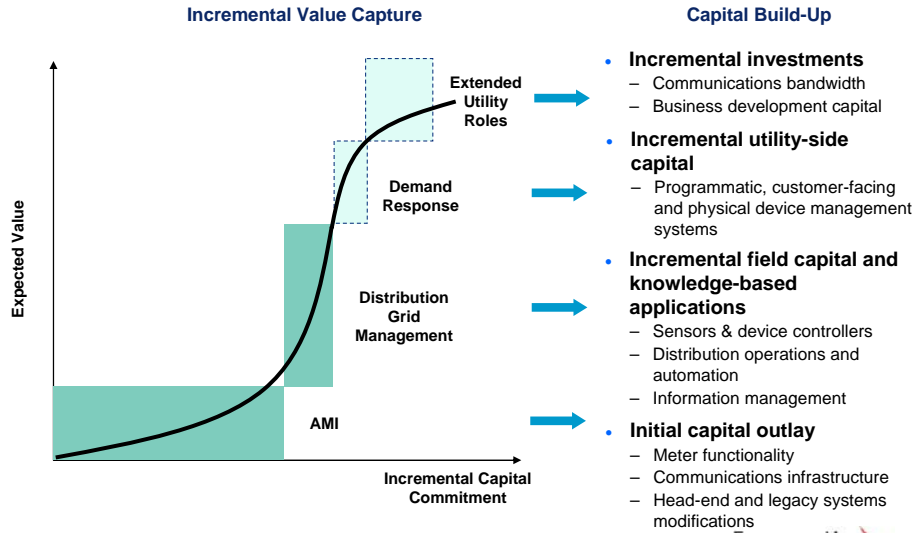
An Enabler of the Smart Grid



Slide Credit: IBM

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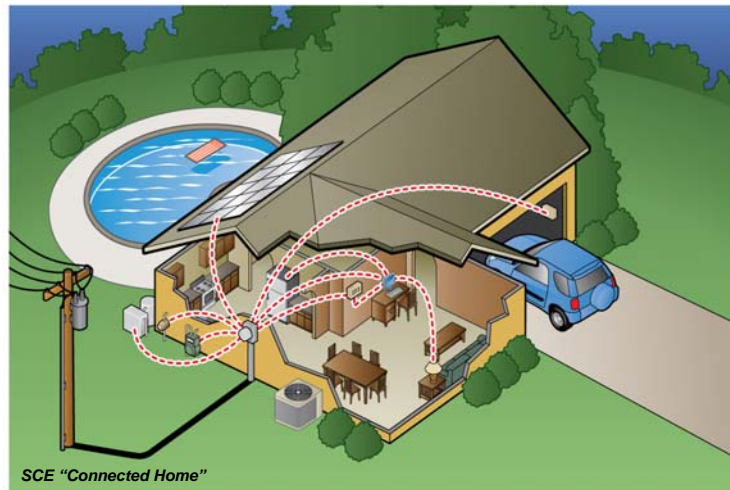
# AMI's Initial Capital Outlay is a Foundation for the Future



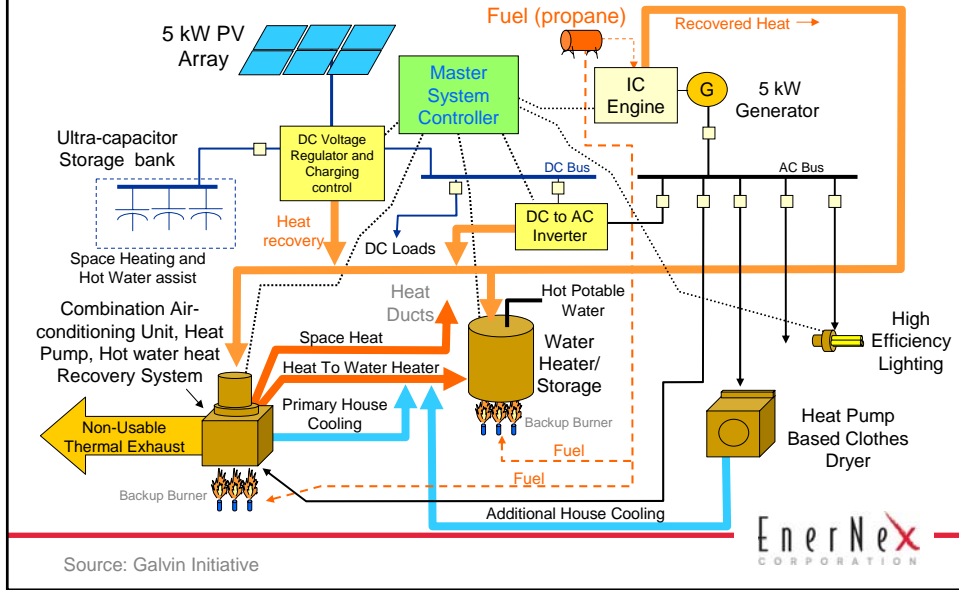
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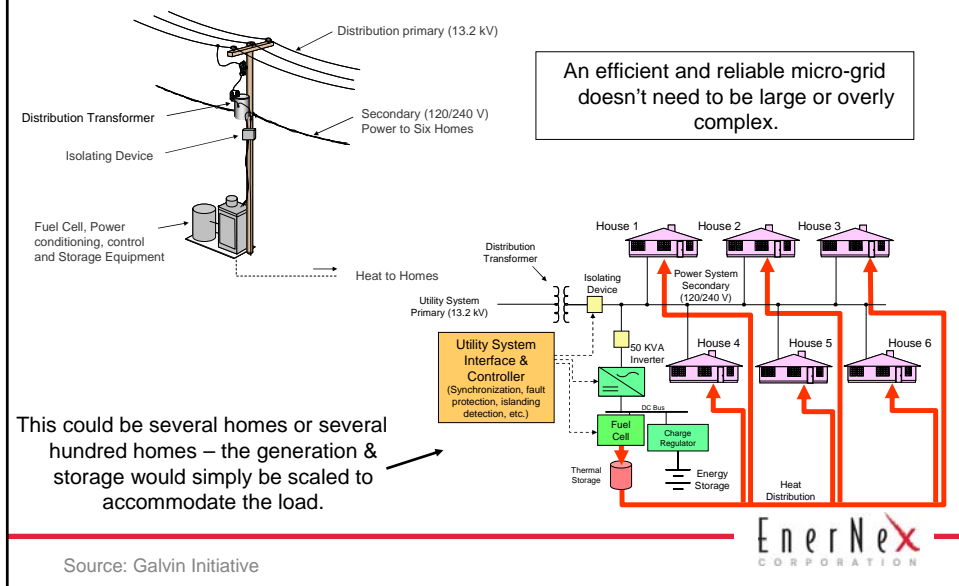
# The SCE "Connected Home" Concept



## Example of a Sophisticated Single Residence Building-integrated Power System (BIPS)

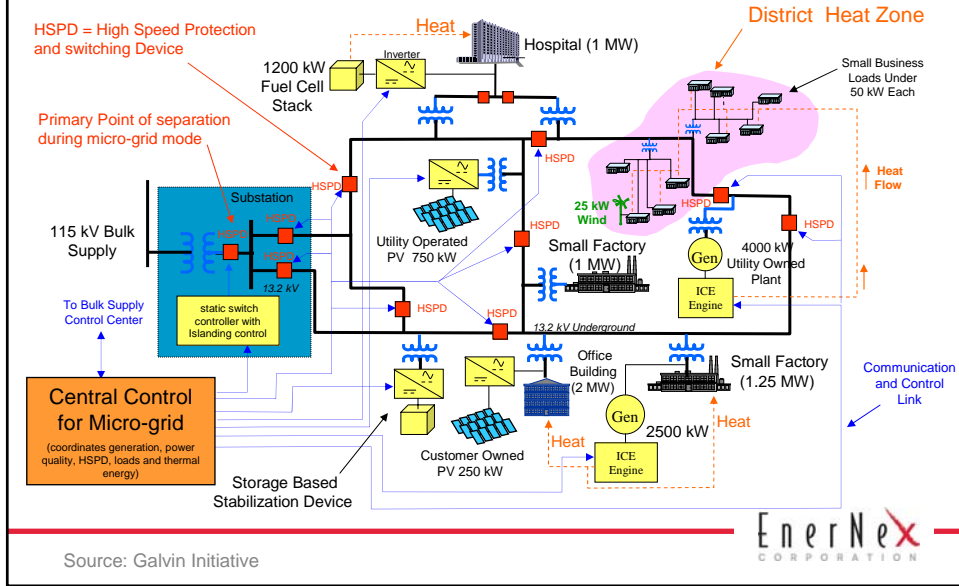


## Example of Residential Micro-Grids

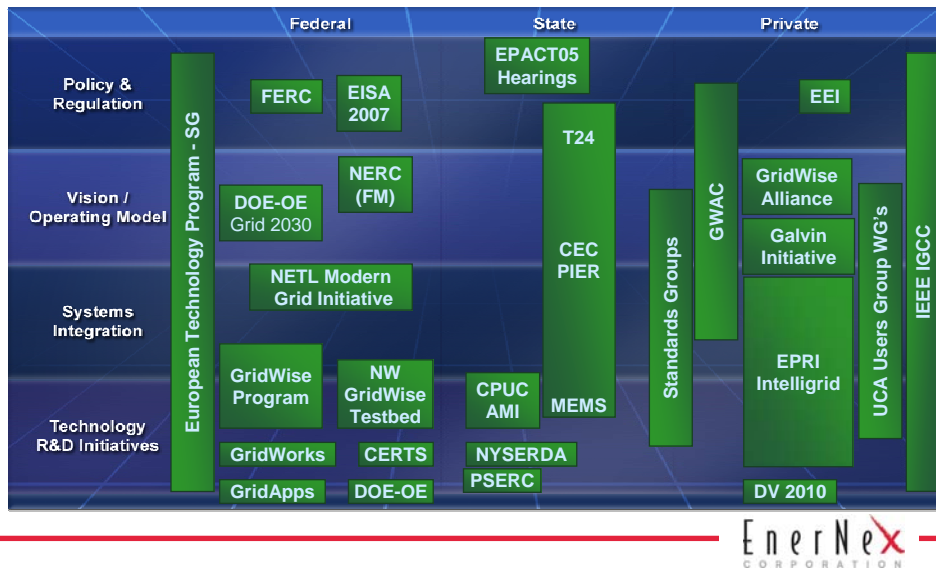




## Example of Primary Network Micro-Grid Suitable for Very High Reliability Applications



## Developers of the Smart Grid



## Who's on first?

There is compatibility between the players in the Smart Grid space:

- GWAC -- working at 30,000' to develop principles and framework spanning entire electricity food chain
- EPRI IntelliGrid -- working at 5,000-15,000' to develop utility-centric, technical project frameworks and implementations
- Modern Grid Initiative – Taxpayer funded effort to enable & accelerate grid modernization including providing analytic support to DOE OE supported demonstration programs.
- GridWise Alliance -- coalition of utilities, technology vendors, and others. Active lobbying effort to influence legislation.
- UCA International Users Group – several working groups and task forces working at the application level to develop common requirements and influence the vendor community – interfaces to SDO's
- DOE and industry participation in all of these efforts
- IEEE Intelligent Grid Coordinating Committee – new group to act as a clearing house for information and assist in coordinating information exchange among all of the above groups



## Questions



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