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## **SMART GRID**

*“You Say You Want a Revolution ...”*

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# The Case For “Revolution”

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***“The world’s energy system is at a crossroads. Current global trends in energy supply and consumption are patently unsustainable ... What is needed is nothing short of an energy revolution.”***

– International Energy Agency (IEA)

# When It Is Good, It Is Very, Very Good, But When It Is Bad, It's Horrid!

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- Electrical outages cost U.S. businesses about **\$50 billion** a year- EPRI
- A rolling blackout across *Silicon Valley* totaled **\$75 million** in losses
- In 2000, the one hour-outage that hit the *Chicago Board of Trade* resulted in **\$20 trillion** in trades delayed
- *Sun Microsystems* estimates that a blackout costs the company **\$1 million every minute**
- The *Northeast* blackout of 2003 resulted in a **\$6 billion** economic loss to the region

# “You Say You Want a Revolution ...”

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**President Obama has called for the installation of 40 million smart meters and 3,000 miles of “smart” transmission lines.**

- The smart grid will “spawn new Googles and Microsofts,” and it is “akin to the transcontinental railroad, the phone system, the interstate highway system and the Internet.”

-Jesse Berst

# “We All Want to Change the World”

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## \$4.5 Billion of stimulus money has been dedicated to Smart Grid

- **November 2008-** *IBM* snags smart-grid pilot deals
- **December 2, 2008-** *Microsoft* to partner with Austin Energy on “Pecan Street” Project
- **April 1, 2009-** *Verizon Wireless* and *ITRON* combine forces to harness the power of wireless technology in Advanced Metering and Smart Grid Market
- **April 21, 2009-** *AT&T* looks most likely to become the first cellular carrier to provide communications link ... all the way to individual smart meters
- **April 23, 2009-** *Echelon* teams with *T-Mobile* for cell-based Advanced Meter Infrastructure (AMI)
- **May 4, 2009-** *Google* looks beyond smart meters for home energy data
- **May 17, 2009-** *Cisco* certifies Smart Grid as the Next Big Thing
- **June 15, 2009-** *Siemens* partners with *eMeter* for Smart Grid
- **June 15, 2009-** *Hitachi, Toshiba, Fuji, and Panasonic* to provide a working Smart Grid system in New Mexico by 2010 led by Japan’s New Energy and Industrial Technology Development Organization (NEDO)
- **June 16, 2009 -** *Qwest* and *Current Group* to provide new framework that allows electric utilities to integrate intelligent grid sensing with Qwest’s existing DSL network which will be used in *Excel Energy’s* “SmartGridCity” project in Boulder, CO

# Shift Happens

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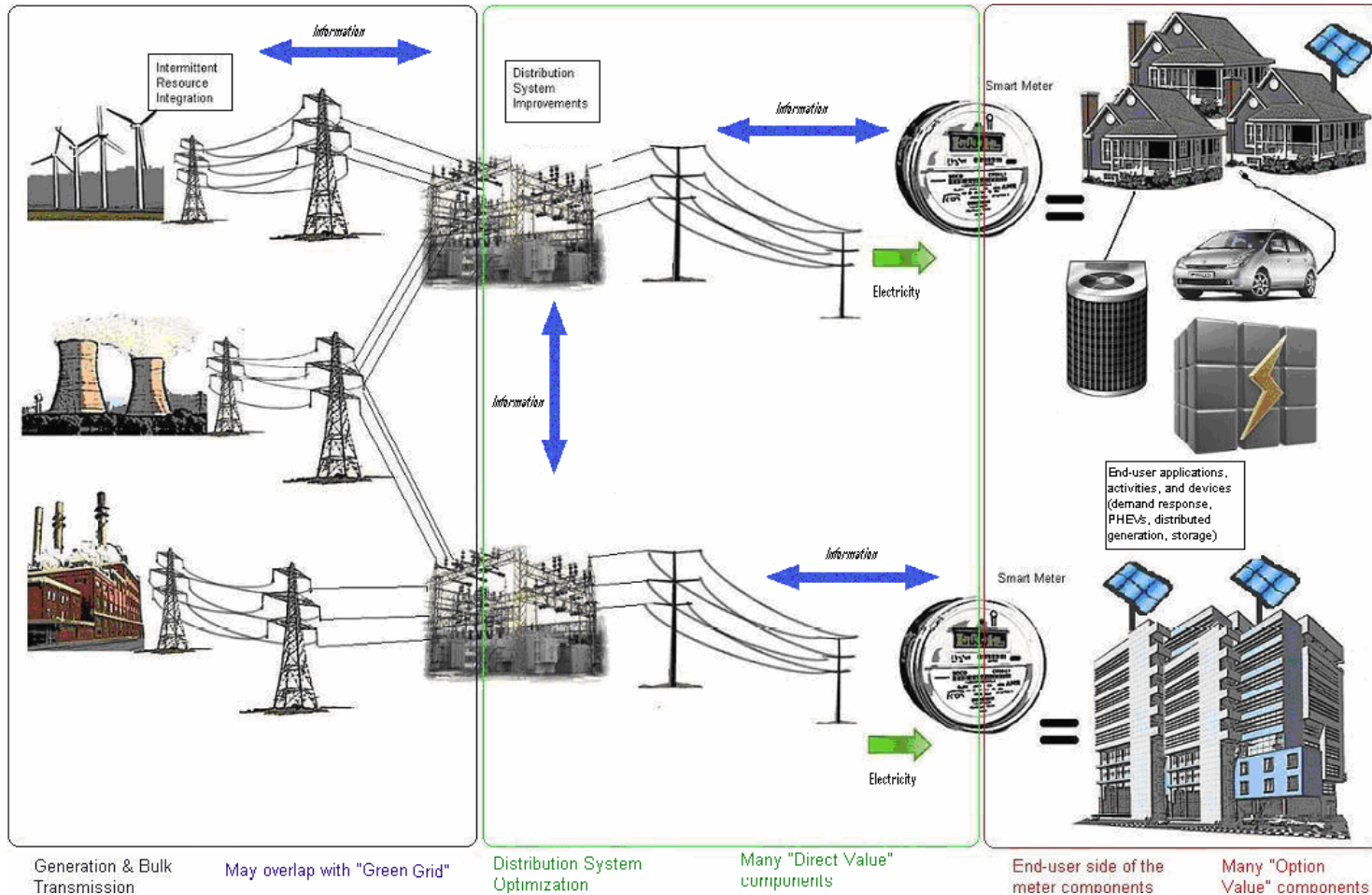
- *Southern California Edison* is on track to install **5 million** smart meters by the end of 2012
- California utility *Pacific Gas and Electric* announced it has installed 2.3 million smart gas and electric meters, putting it on track to deploy nearly **10 million** by the end of 2011
- *Glendale Water & Power* is ready to change out **83,000** electric meters and **34,000** water meters to AMI – April 29, 2009
- *Boulder, Colorado* is aiming to become the world's first smart grid city by year's end partnering with Excel Energy – February 10, 2009
- *Florida Power & Light*, partnering with Cisco, to provide smart meters to **1 million** homes in the Miami area in the next two years
- *Duke Energy* announces partnership with Cisco to make the power grid smarter across its **11 million** customer footprint – June 9, 2009

# A “Smart Grid” Combines Electrical and Intelligence Infrastructures

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- **Builds on** many technologies in use by electric utilities
- **Adds to** communication and control capabilities to optimize the operation of the grid
- **Better integrates** new technologies such as distributed generation, solar and wind energy, smart-metering, lighting management systems, distributed automation, plug-in electric vehicles, and many more
- **Definition** is still a work **in progress** by NIST (National Institute of Standards), EPRI (Electric Power Research Institute), and others

# Smart Grid Architecture



- Poster Child for Smart Grid
- “Smart” bi-directional meters for every customer
- Remote meter reading
- Remote connect and disconnect
- Enhanced outage detection
- Enhanced Time-of-Use rates
- Load control (demand response) using programmable HAN (home area network) devices, i.e. thermostat, water heater, etc.
- Some include built-in SIMs for access to cellular data networks
- Need uniform standards to lessen the risk to early adopters

- **Wireless Technologies:** multiple address system radio, paging networks, spread spectrum radio systems, WIFI (802.11 b/g), WiMax (802.16), 3G cellular, TDMA wireless (IS-136), CDMA wireless (IS-2000), very small aperture terminal (VSAT) satellite, 4G (LTE/WiMAX) cellular
- **Wireline Technologies:** Fiber to the home (FTTH), Digital subscriber line (DSL), Hybrid fiber coax (HFC)
- **Broadband over Power Line-** IEEE 1625 a/o January 2009

# Security- Mischief and Terrorism

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- **Whether a physical or cyber attack, the smart grid must have two different attack strategies:**
  1. Attacks **on** the power system, in which the infrastructure itself is the primary target.
  2. Attacks **through** the power system, in which attackers take advantage of the power system networks to affect other infrastructure systems, such as telecommunications, financial, or government.

**January 2008-** “CIA analyst reported that hackers had attacked foreign utilities, turning out the lights in several foreign cities.” – Washington Post

**May 18, 2009-** “If you want to create mischief one very good way to create a great deal of mischief is to actually bring down the smart grid system. This system has to be incredibly secure.” - *Energy Secretary Steven Chu*

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- [www.energy.gov](http://www.energy.gov) – U.S. Department of Energy
- [www.nema.org](http://www.nema.org) – National Electrical Manufacturers Association
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- [www.gridwise.org](http://www.gridwise.org) - GridWise Architecture Council
- [www.ietf.org](http://www.ietf.org) – Internet Engineering Task Force
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- [www.nist.gov/smartgrid/InterimSmartGridRoadmapNISTRestructure.pdf](http://www.nist.gov/smartgrid/InterimSmartGridRoadmapNISTRestructure.pdf) - Report to NIST on the Smart Grid Interoperability Standards Roadmap