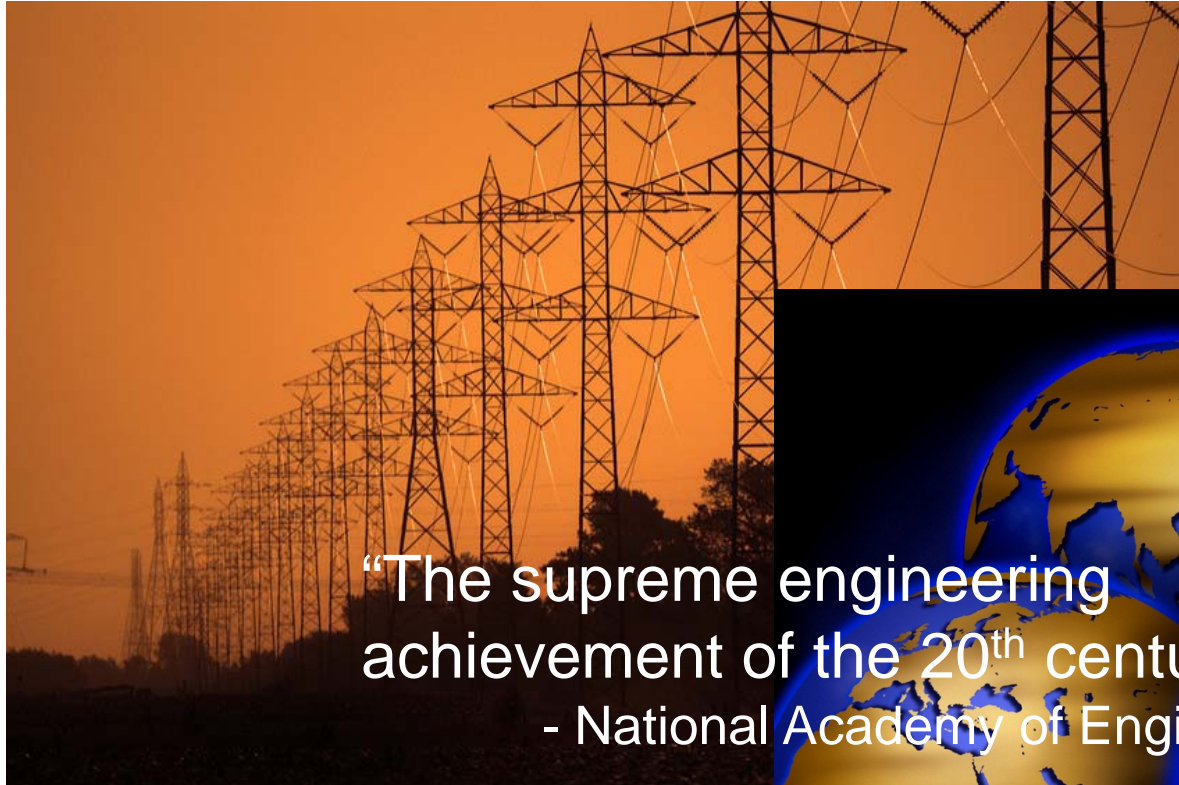

The Smart Grid and Consumer Electronics

George W. Arnold, Eng.Sc.D.
National Coordinator for Smart Grid Interoperability
National Institute of Standards and Technology
World Electronics Forum
January 10, 2011



The Electric Grid



“The supreme engineering
achievement of the 20th century”
- National Academy of Engineering



The Electric Grid 100 Years Ago

It's not too different today!



Wall Street, 1913

Edison Pearl Street Station, 1882

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

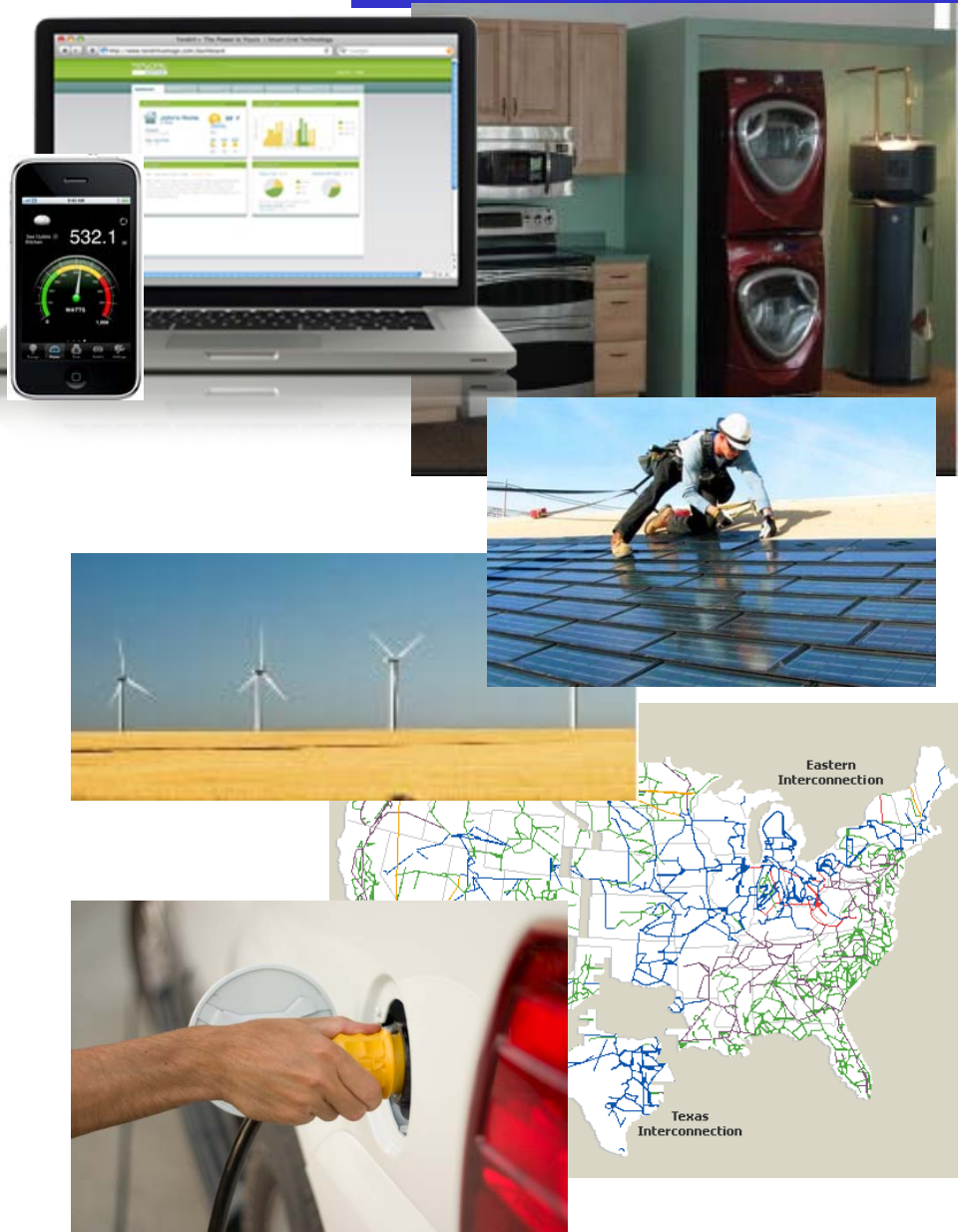


“We’ll fund a better, smarter electricity grid and train workers to build it...”
President Barack Obama

“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

The Grid Needs to be Modernized

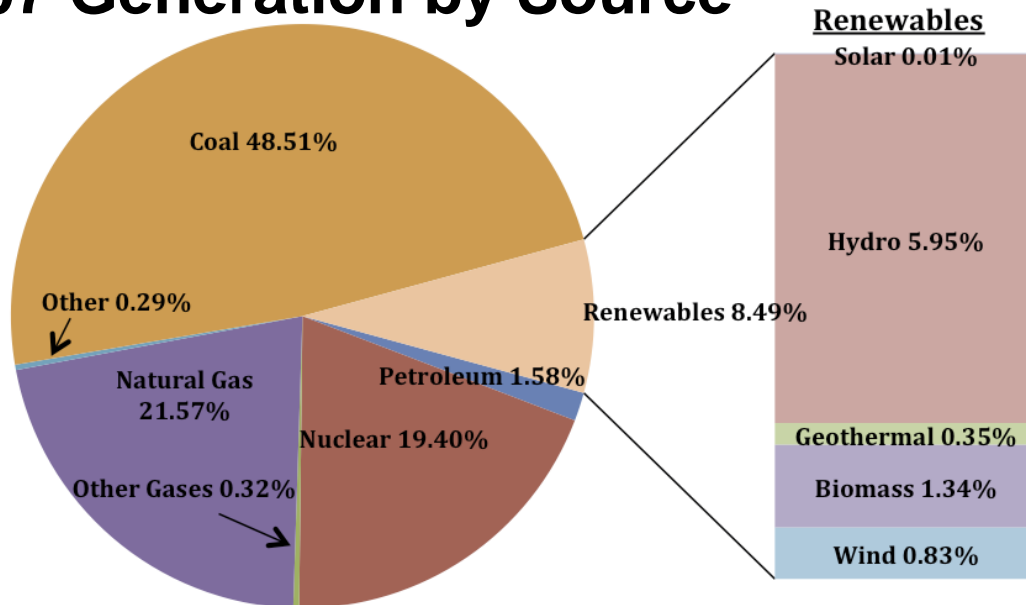


The Smart Grid integrates information technology and advanced communications into the power system in order to:

- Reduce Costs
- Use More Renewables
- Improve Reliability
- Support Electric Vehicle Charging

Reducing Cost

2007 Generation by Source



Sources:
(1) DoE EIA
(2) Brattle Group

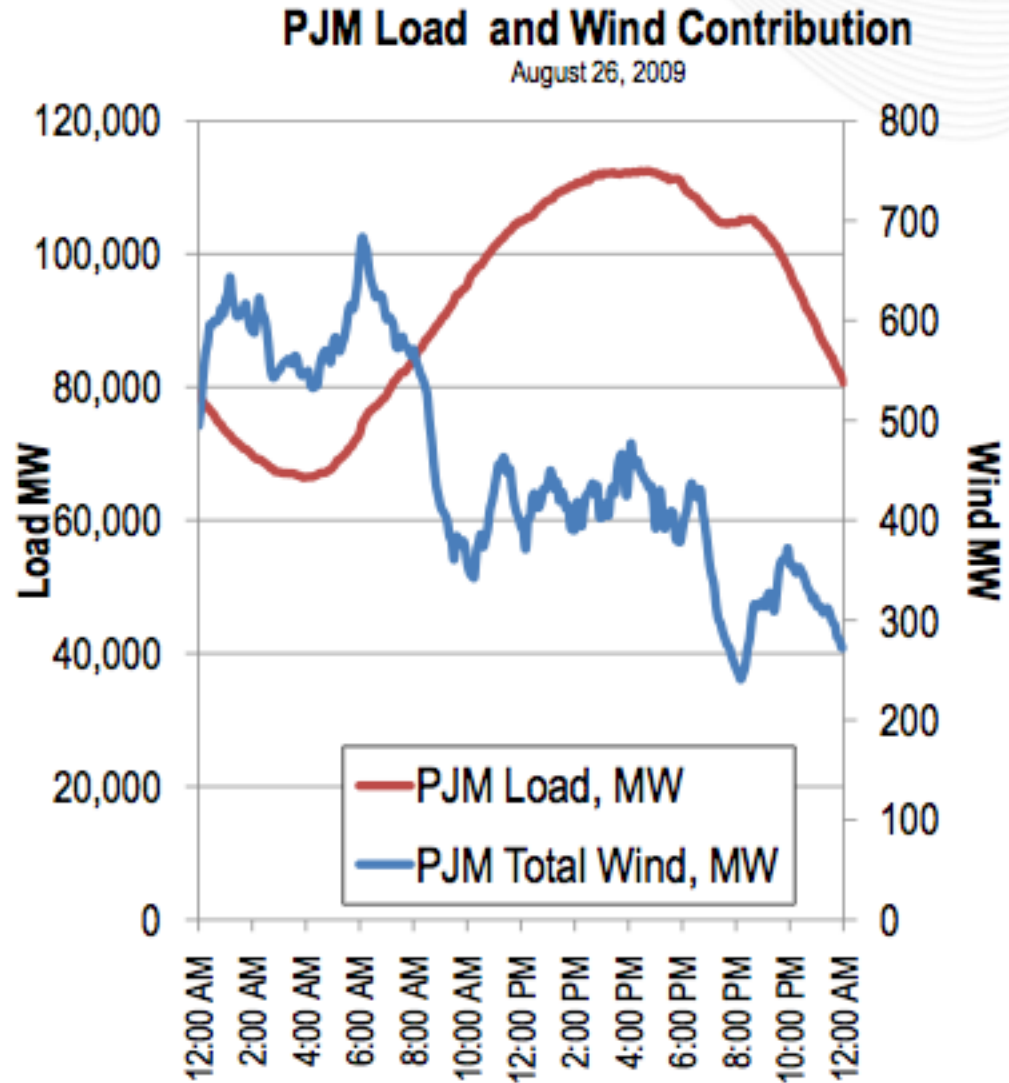
- Half of U.S. coal plants are > 40 years old
- Upgrade or replacement will cost \$560 B by 2030
- Smart grid helps utilities *and* consumers reduce both peak and average use – thus reducing investment otherwise required
 - US per capita annual electricity usage = 13000 kWh
 - Japan per capita annual usage = 7900 kWh

Using More Renewables

- Electricity generation accounts for 40% of human-caused CO₂
- Smart grid enables dynamic control needed for much greater use of wind and solar

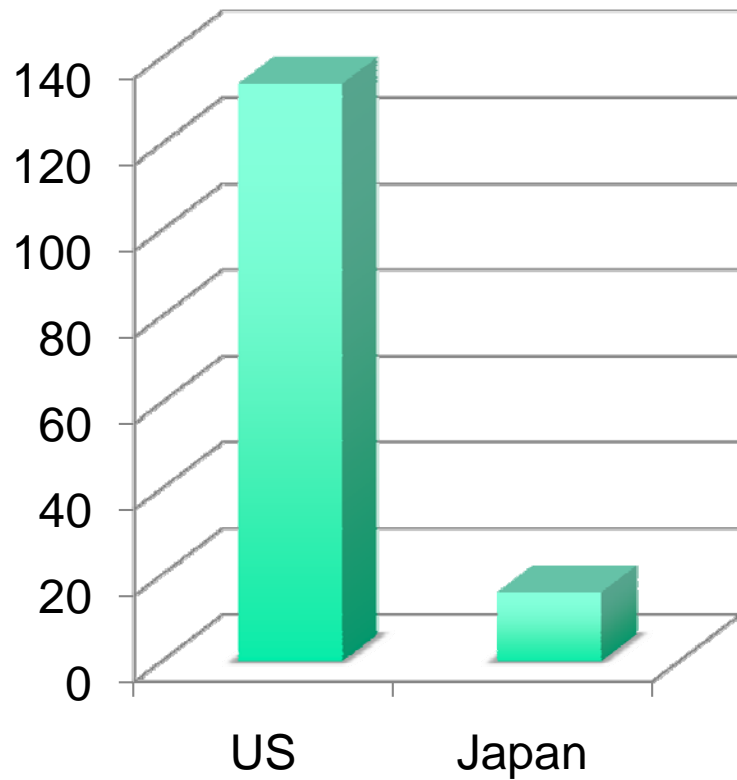


Source: PJM



Increasing Reliability

**Power outages
Minutes/year/customer**



- \$80 Billion /year cost to U.S. economy
- Smart grid sensors and automated controls will improve reliability

Sources:

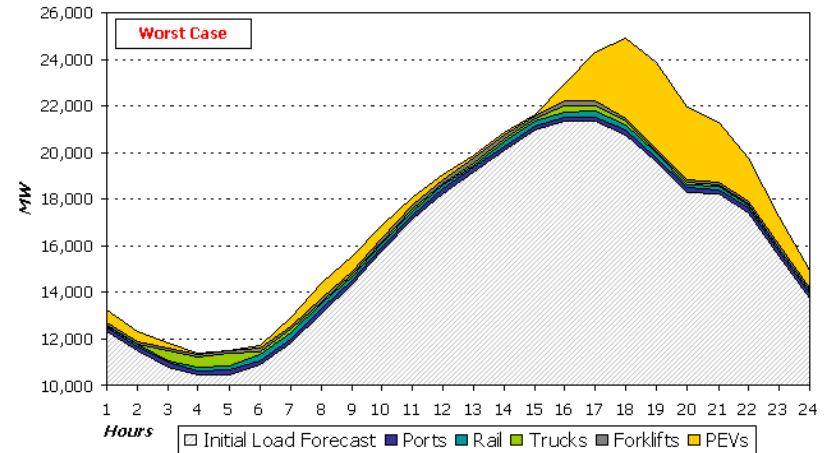
- (1) IEEE Benchmarking 2009 Results
Distribution Reliability Working Group
- (2) Japan Ministry of Economy Trade and
Industry 2010
- (3) Lawrence Berkeley National Laboratory

Electric Vehicle Charging

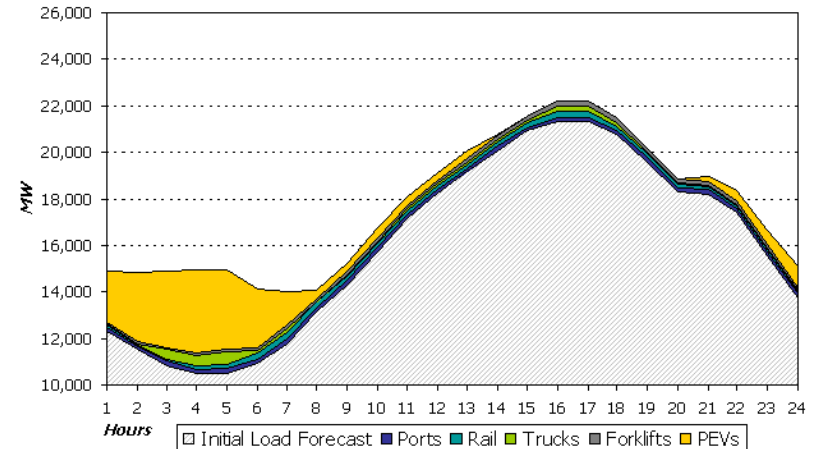


- Opportunity to use idle capacity on the grid
- Smart grid enables charging management to avoid overload during peak periods

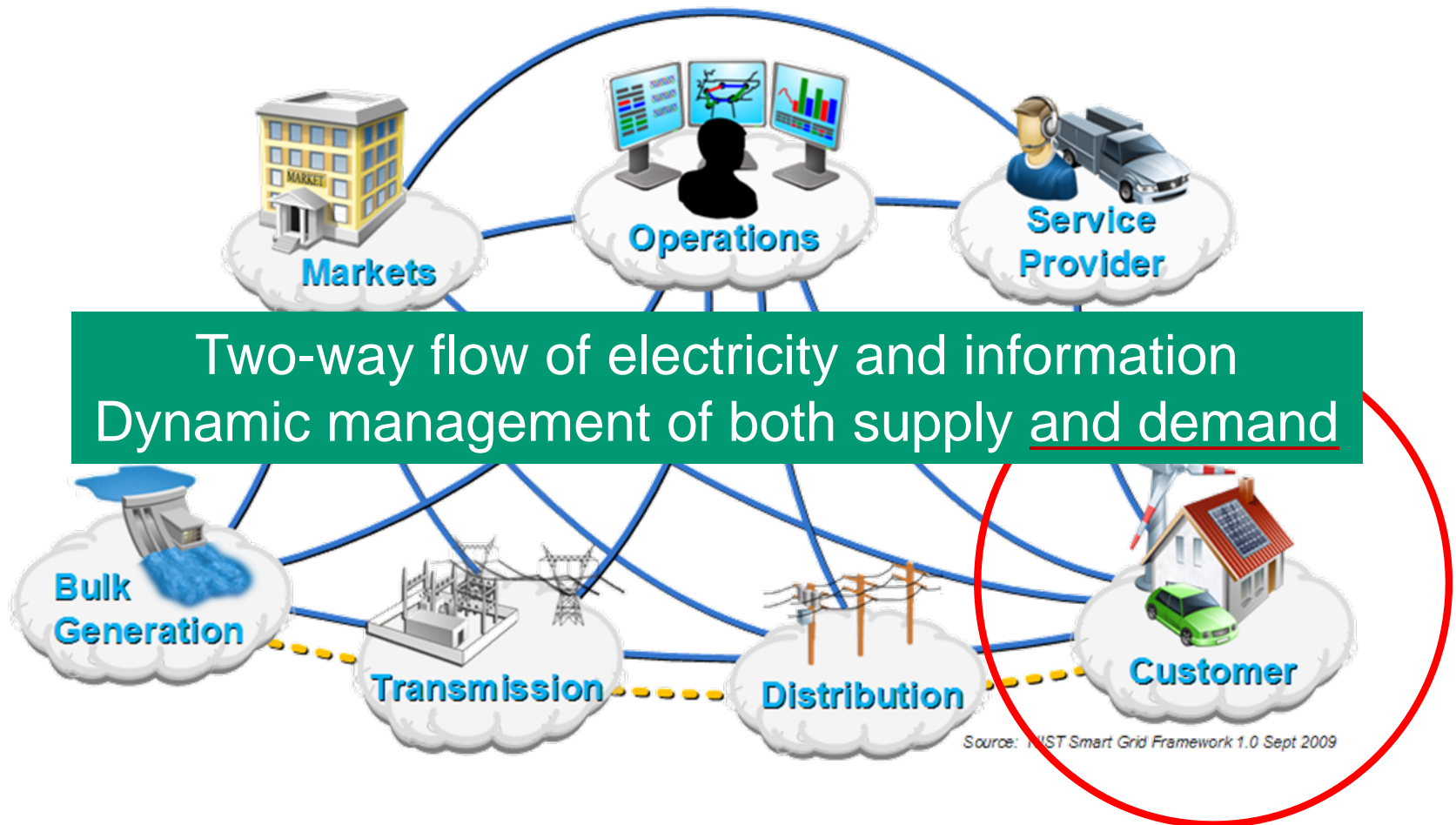
2020 SUMMER LOAD IMPACT – NO UTILITY INVOLVEMENT*



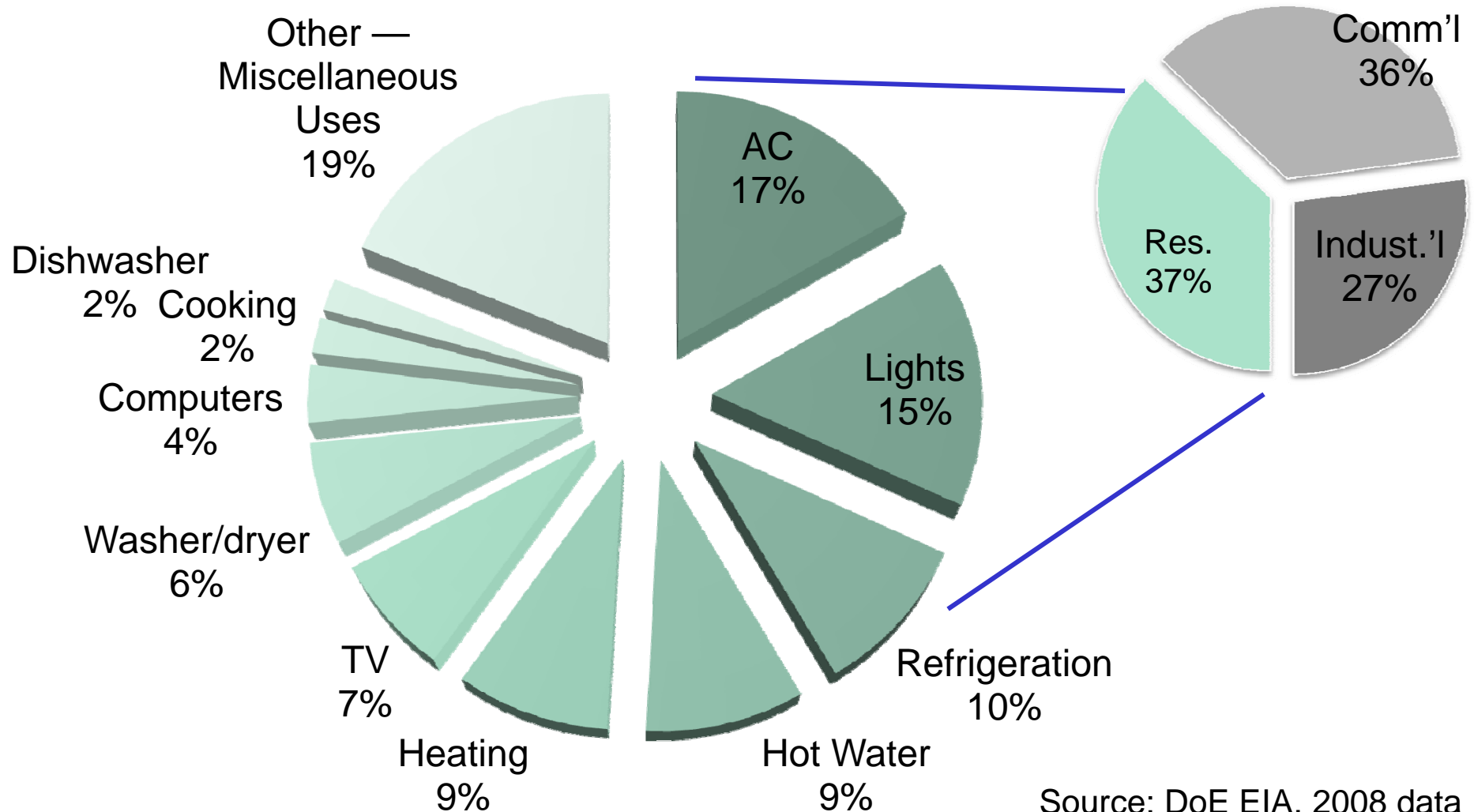
2020 SUMMER LOAD IMPACT – WITH UTILITY INVOLVEMENT*



The Smart Grid Essential Concept



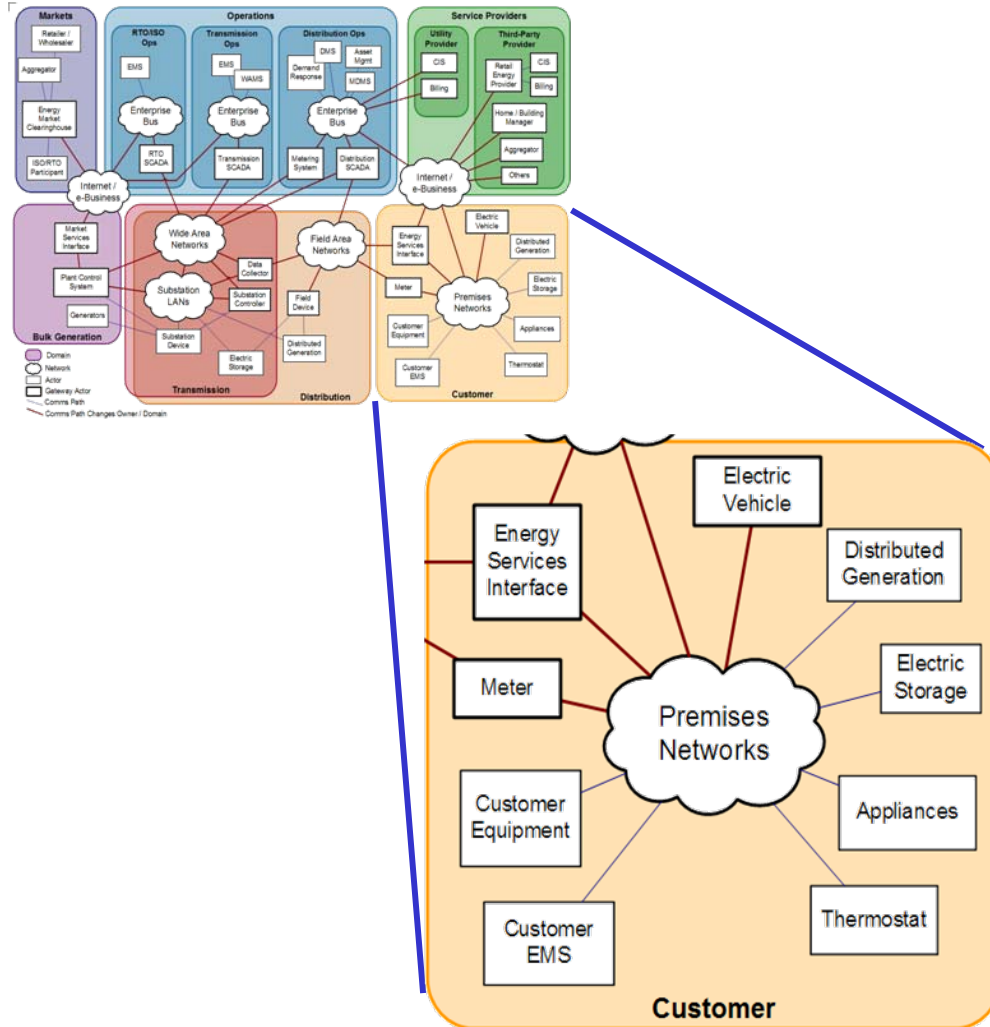
Where Does the Power Go?



Source: DoE EIA, 2008 data

Consumer Electronics Can Drive Innovation on Customer Side of the Meter

NIST Smart Grid Reference Model



- Home area network
- Energy services interface
- Home energy management systems/apps
- Controllers
- Displays
- Sub-metering devices
- Embedded smart grid-aware intelligence



Standards are Critical: Smart Grid Interoperability Panel

- Public-private partnership created in Nov. 2009
- 620 member organizations
- Open, public process with international participation
- Coordinates standards developed by Standards Development Organizations (SDOs)
 - Identifies Requirements
 - Prioritizes standards development programs
 - Works with over 20 SDOs including IEC, ISO, ITU, CEA, IEEE, ...
- Web-based participation



SGIP Twiki:
<http://collaborate.nist.gov/twiki-ssggrid/bin/view/SmartGrid/SGIP>

Benefits of Global Standards

- Avoid unnecessary adaptations for different markets
- Promote supplier competition
- Encourage innovation
- Lower costs for suppliers
- Lower costs for utilities
- Lower costs to end customers



Further Information

- Web portal: <http://www.nist.gov/smartgrid>
- Contact:
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 - Telephone: +1.301.975.2232

