



**EPR**I

ELECTRIC POWER  
RESEARCH INSTITUTE

## The Electricity Technology Portfolio of the Future


**Barbara Tyran**

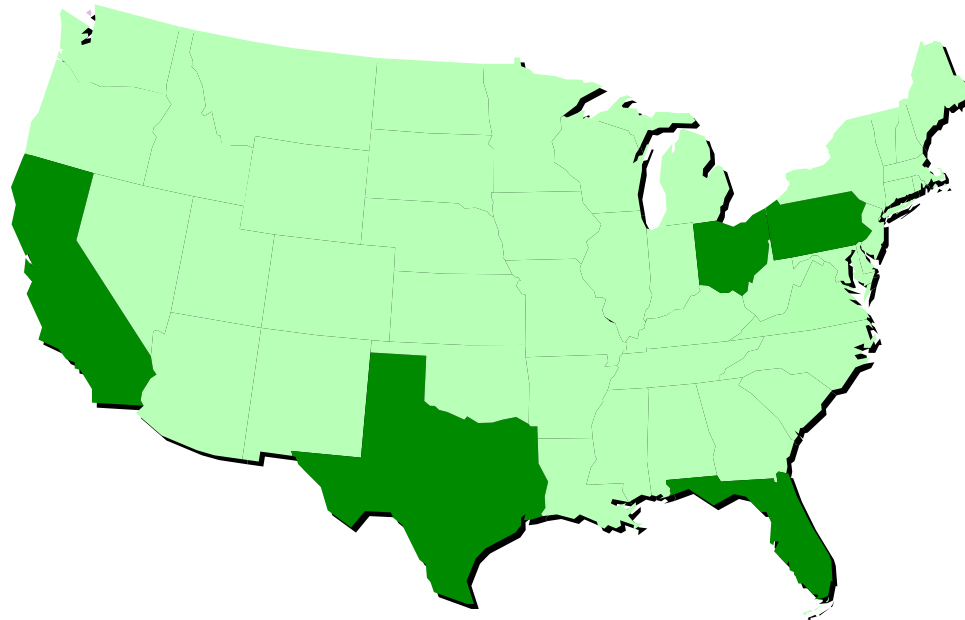
**Director, Washington Relations**

**13th Annual Washington Energy Policy  
Conference**

**April 2009**

# Where energy demand is increasing...

- **2008 Annual Energy Outlook - **
  - **30%** increase in U.S. electricity consumption by 2030.
  - New load equivalent to 2006 electricity usage in California, Texas, Florida, Ohio and Pennsylvania combined!



# Bringing it home...Consumer Electronics

## PLASMA TV



42"  
250W

vs.



27"  
100W

Consumes 2.5x more energy

## SET TOP BOX



30W

=



30W



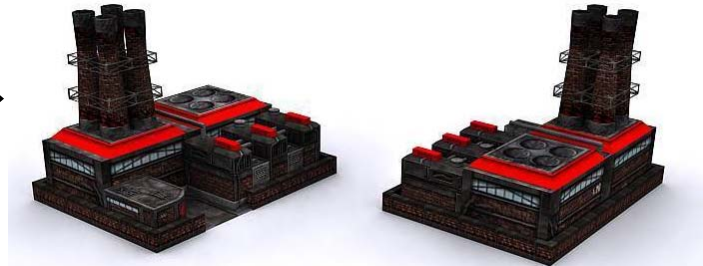
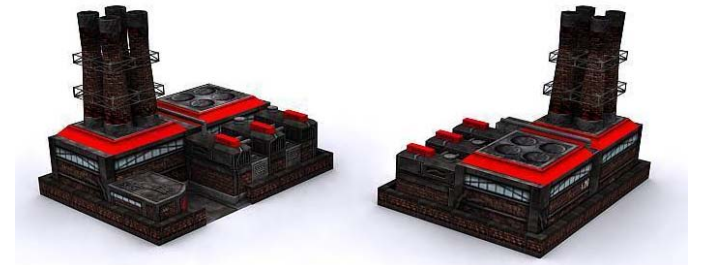
2 set top boxes consume as much energy in one year as a refrigerator

# Bringing the picture into focus...

**Digital Photo Frames**  
1 per U.S. home...



**250 MW Power Plants\***



**\*250 MW plant can serve 160,000 full homes**

# Energy Efficiency Potential Study

## Potential U.S. Energy Efficiency Savings - Now to 2030

- Detailed micro-economic model
- Calibrated with input from industry experts
- Database of energy efficiency technologies



Latest Research Results from EPRI's Living Laboratory

# EPRI's Living Laboratory Recently Featured in TIME

**NATION**

## Wasting Our Watts

We don't need new drilling or new power plants. We need to get efficient

BY MICHAEL GRUNWALD



Photographs for TIME by Jeff Jacobson—Redux



the greentech economy. Clearly, it needs an agent. But it's a simple concept: wasting less energy. Or more precisely, consuming less energy to get the same amount of heat for your shower, light for your office and power for your factory. It turns out to be much less expensive, destructive and time-intensive to reduce demand through efficiency than to increase supply through new drilling or new power plants. A nationwide push to save "megawatts" instead of building more megawatts could help reverse our unsustainable increases in energy-hogging and carbon-pewing while creating a slew of jobs and saving a load of cash.

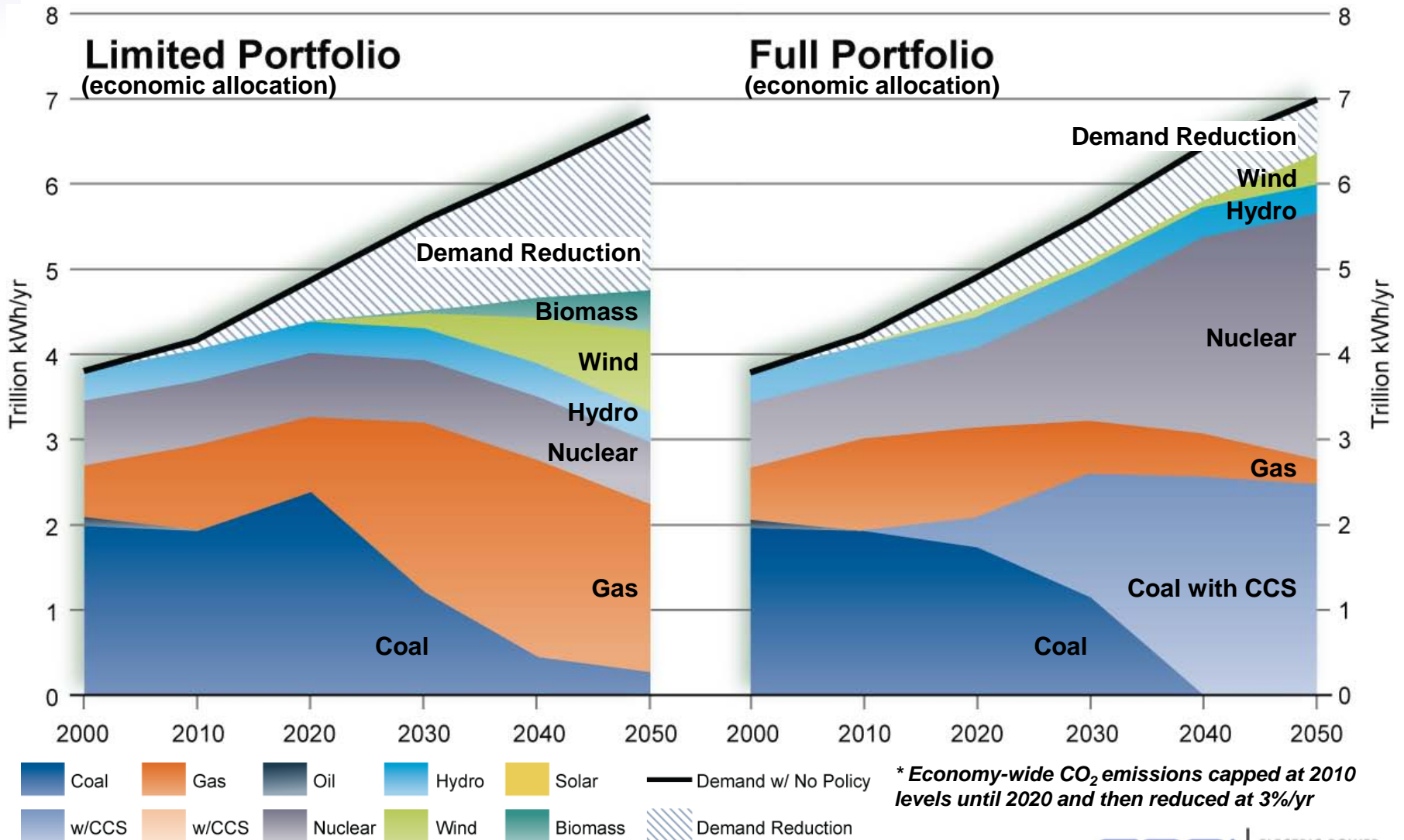
Now this may sound like Jimmy Carter's 30-year-old plea for us to turn down the heat and put on sweaters or like an eco-lecture nagging us to turn off lights, drive less and otherwise change our behavior to save energy. It would be nice if we did, but that's conservation, not efficiency. We don't have to sacrifice comfort or change routines to get efficient. Doing less with less may be admirable, but efficiency is about doing the same or more with less. And studies by groups as diverse as the Natural Resources Defense Council (NRDC), the U.S. Chamber of Commerce and even the National Petroleum Council have identified efficiency as the way

### Six Ways to Waste Less

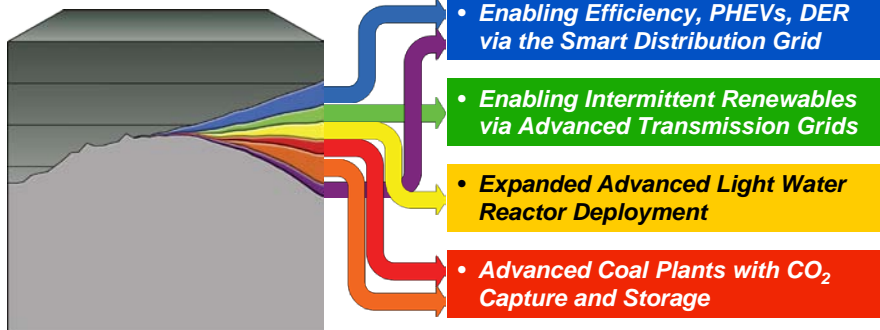
- 1) A well-integrated system precisely measures lighting levels 2) An advanced meter can protect for during off-peak hours, then use it for cooling during peak periods 3) Capacitors boost performance in TVs and Blu-ray drives 4) Triple-layer glass windows let much less heat than double-paneled, gas-filled ones 5) Flaming heating and cooling equipment in a soiled, insulated attic can cut home-energy costs by 25% 6) LED street lamps use about 25% less energy than conventional metal halide fixtures

# U.S. Electricity Generation: 2000 to 2050

(two scenarios meeting the same economy-wide CO<sub>2</sub> constraint\*)



# Key Technology Challenges



- Standardized communications
- Advanced, mobile metering
- Interoperability
- Distributed computing
- Large scale energy storage
- Grid management technologies
- Wide-area monitoring
- Shortened construction times
- Integrated spent fuel management strategy
- Higher efficiency advanced coal plants
- High-efficiency, cost-effective CO<sub>2</sub> capture
- Commercial, large-scale CO<sub>2</sub> storage

# Action Framework... Four Evolving Infrastructures

**Low-Carbon  
Generation**



**Smart Grids**



# Smart Grid

## *State of the technology...*

- We are in the infancy in developing a smart grid
- Smart grid can mean different things to different utilities
- No standards for inclusive technologies
- Smart capabilities vary from utility to utility

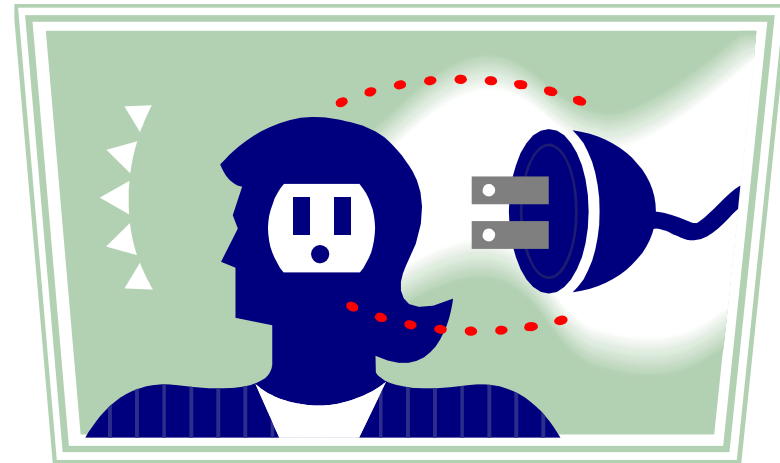


*ElectriNet*<sup>SM</sup>

# Smart Grid

*Where we want to be...*

- Smart power delivery infrastructure encompassing physical power, storage, advanced information technology and intelligent sensors and applications
- Numerous impacts
  - Operate the grid reliably at the margins when connecting to renewable resources
  - Dynamic grid adjustment to reduce losses and increase efficiency
  - On-line asset health assessment to minimize reliability events



*ElectriNet*<sup>SM</sup>

# Action Framework... Four Evolving Infrastructures

**Low-Carbon  
Generation**



**Smart Grids**

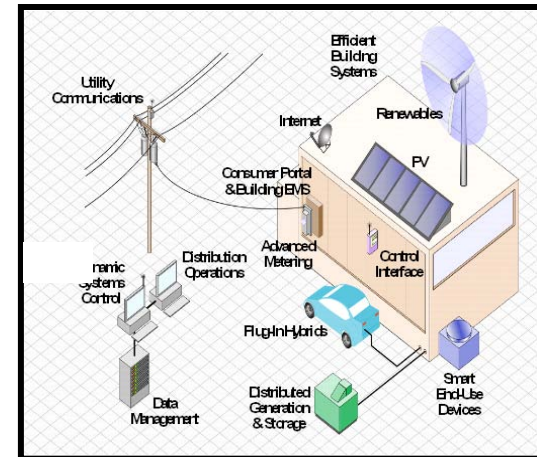
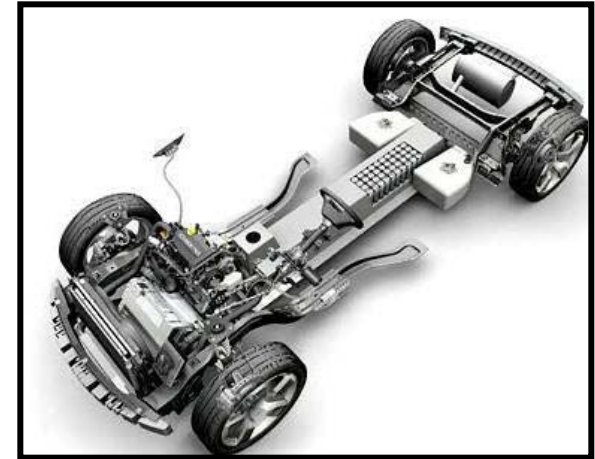


**Electric  
Transportation**

# Electric Transportation

## *State of the technology...*

- PHEV technology is ready now
- Hybrids remain dependent on combustible fuels
- Existing challenges remain for fully electric or fuel cell vehicles
- All electric PHEV 40 mile range could meet the transportation requirements for 80% of vehicles
- Widespread adoption of PHEVs can reduce GHG emissions by 2050 the equivalent to removing 82.5 million passenger cars from the road



*Electri*Net<sup>SM</sup>

# Action Framework... Four Evolving Infrastructures



**Low-Carbon  
Generation**



**Smart Grids**

**Local Energy  
Networks**



**Electric  
Transportation**

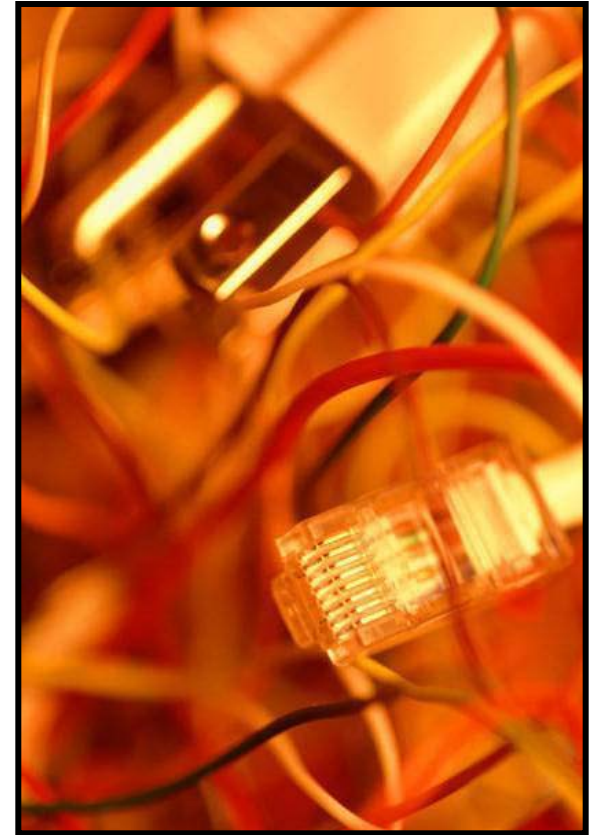


# ElectriNet – Local Energy Networks

## *State of the Technology*

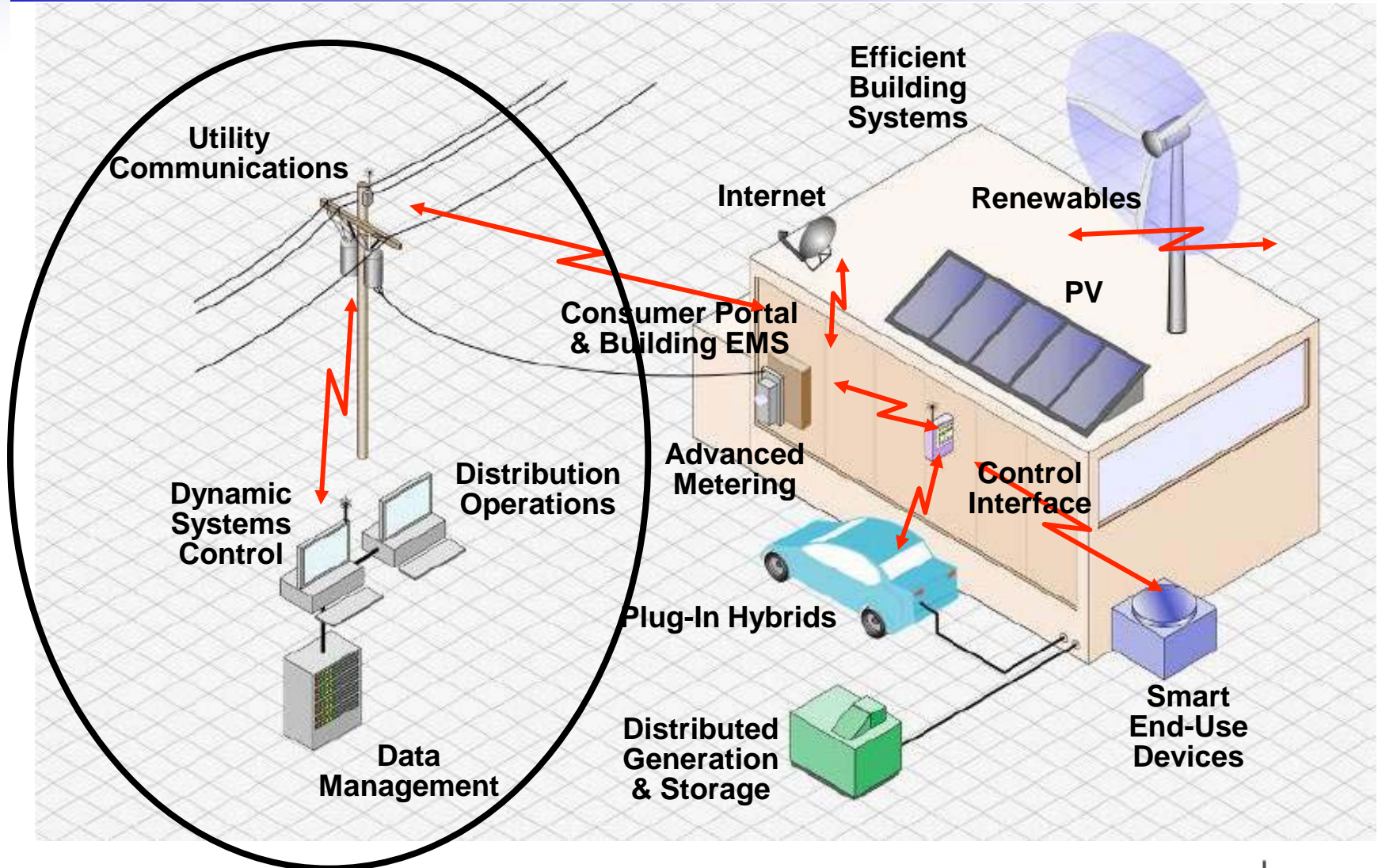
### *State of the technology...*

- PV and local storage technology is reaching maturity
- PHEV connectivity not completed
- Stand alone operations only
- Missing energy network controllers for in-Network operations
- Missing standard for interactive grid interface
- Multiple proprietary and standard communication networks available

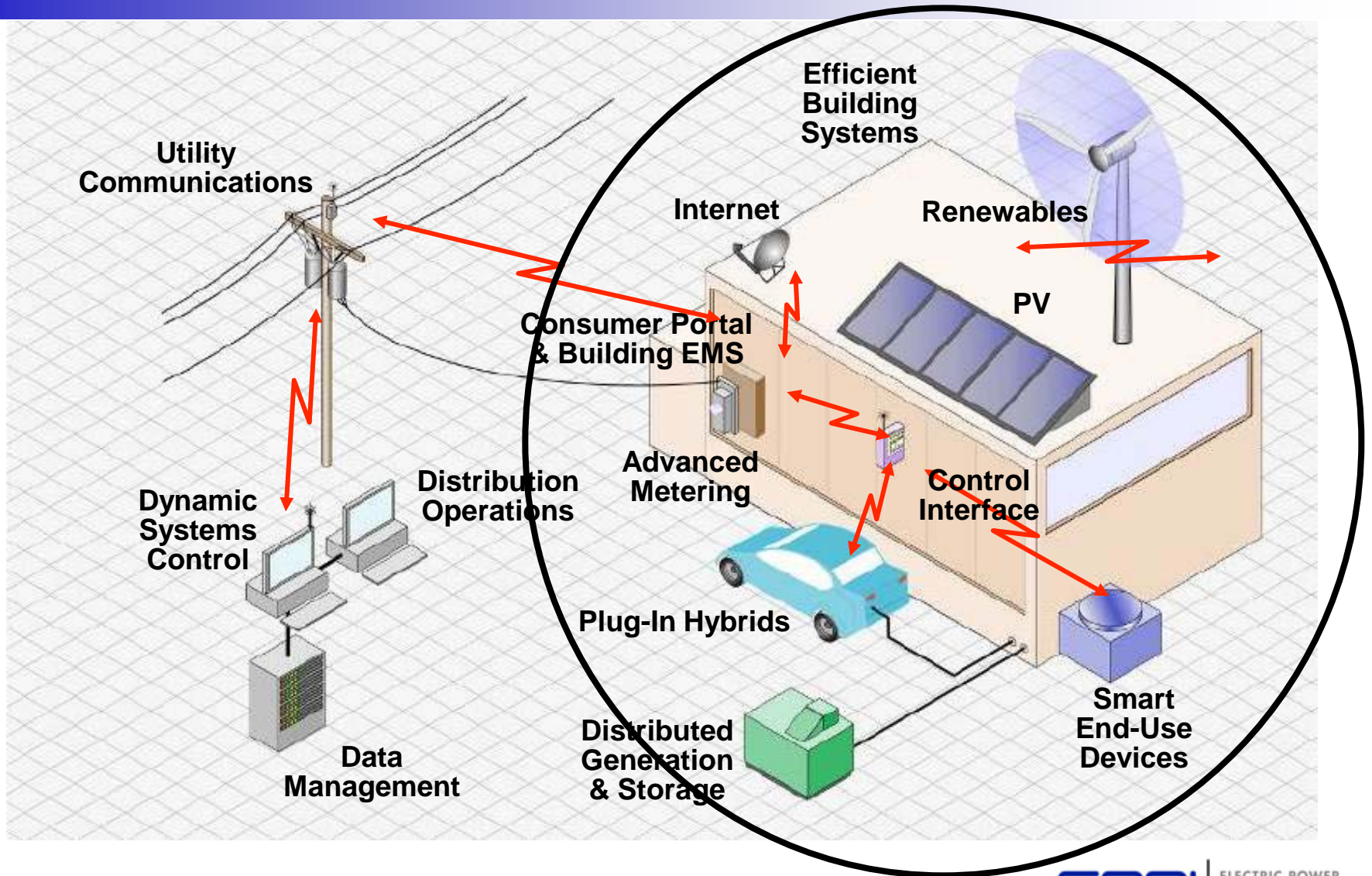


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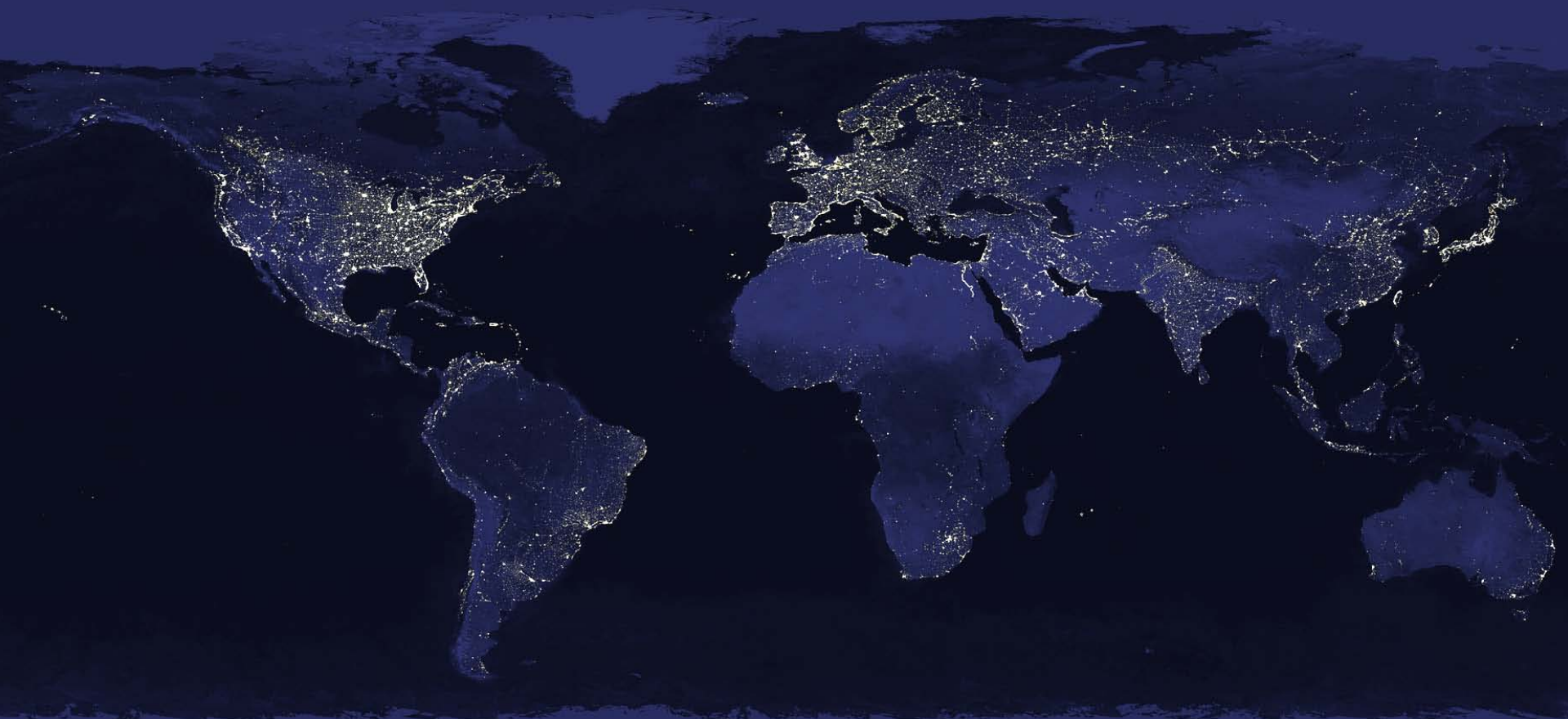
# Smart Grids and Local Energy Networks



# Smart Grids and Local Energy Networks



Together...Shaping the Future of Electricity



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