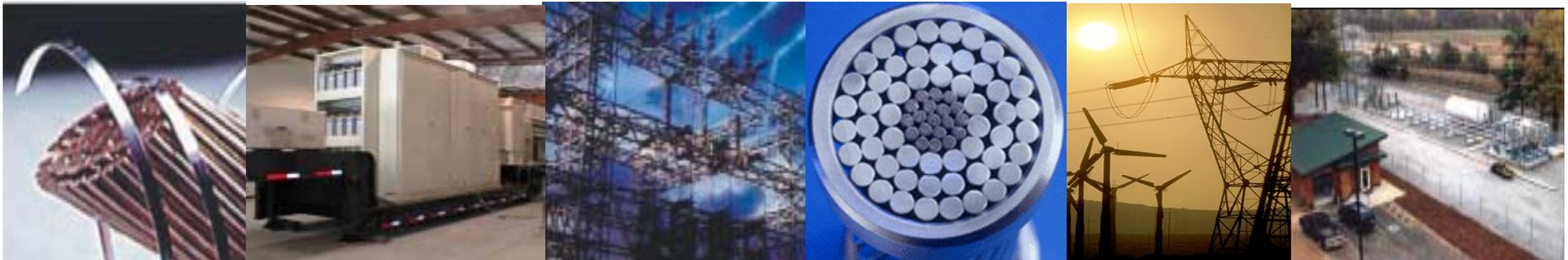




# *Transforming the Grid to Revolutionize Electric Power in North America*

*October 2003*

*Bill Parks  
U.S. Department of Energy*



# Electricity and Economic Growth



“If the energy structure of this country is inadequate or in some way excessively costly, it will undermine economic growth, and is therefore a major issue that must be addressed.”



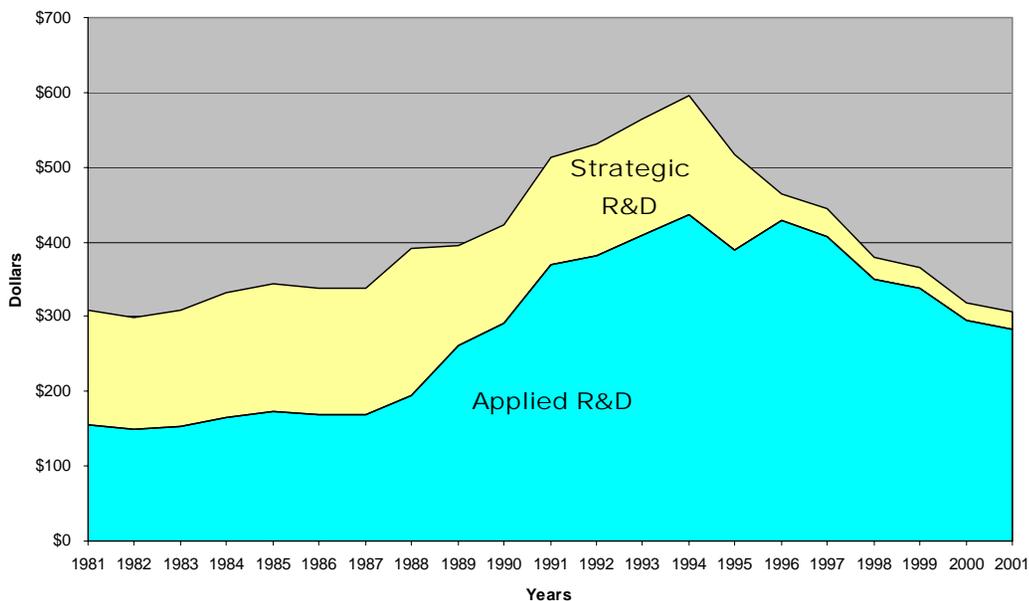
**Alan Greenspan**  
**Chairman, Federal Reserve Board**  
**January 25, 2001**

# Declining T&D R&D and Investment



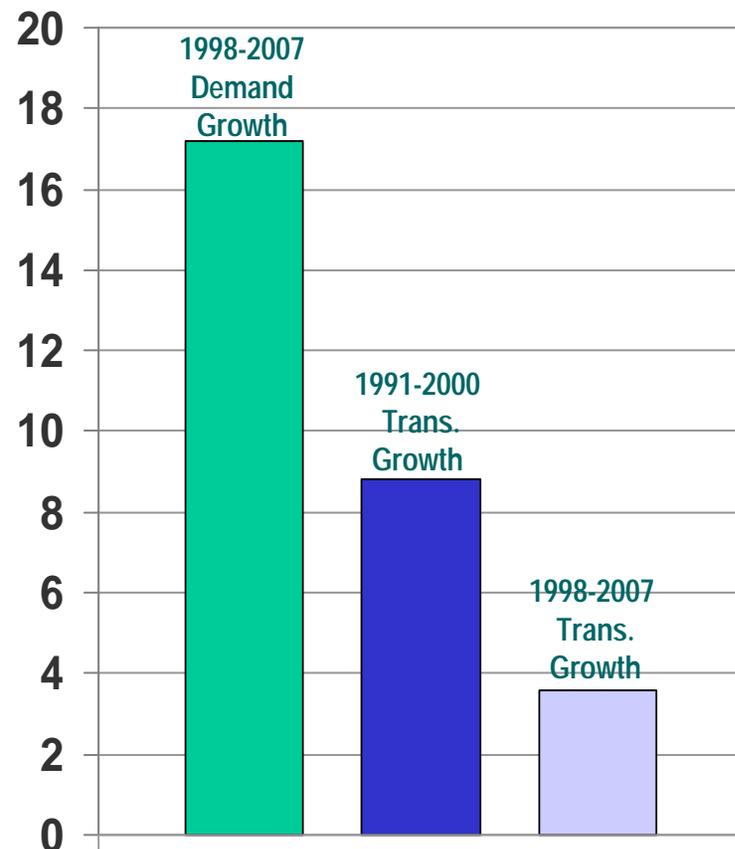
## EPRI R&D Funding

Strategic R&D dropped from \$160 million to less than \$25 million in 7 years



Source: EPRI

Percent Change



Source: NERC

# Aging Power Delivery Infrastructure...



## TVA's system...

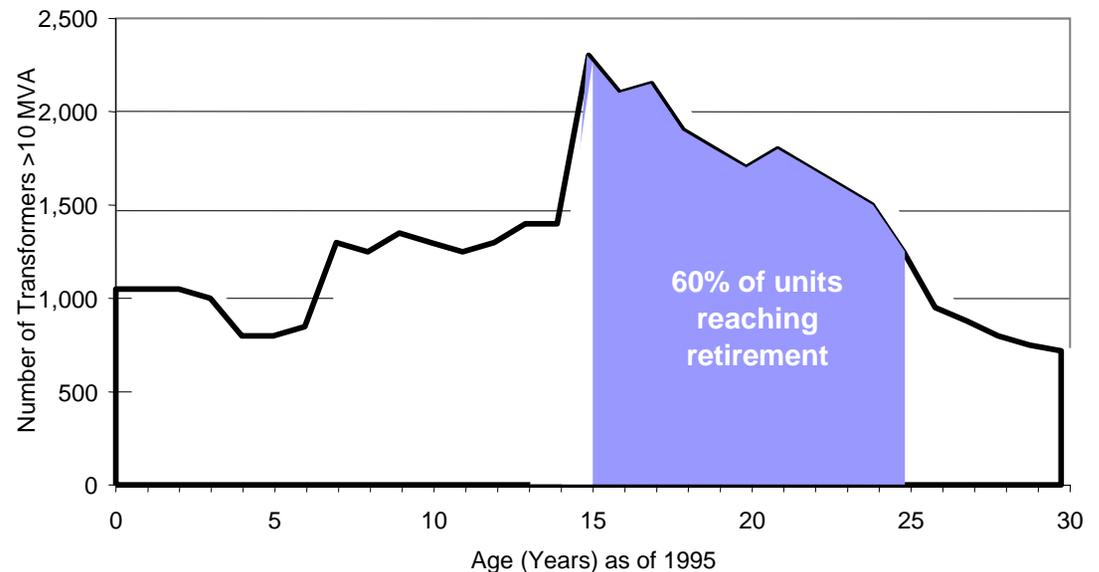
- 64% of transmission structures are 25 years or older
- 73% of transformers are 25 years or older
- 53% of breakers are 25 years or older (31% are 35 years or older)

...for transactions that have grown from 20,000 annually in 1996 to 250,000 annually in 2001 in TVA's system alone

Source: Tennessee Valley Authority

...is inadequate for the digital era

## Age Distribution of Large Transformers



Source: Waukesha Electric Systems 1997

# Blackout - August 14, 2003



*Cost of Power  
Disturbances:  
\$25 - \$188 billion  
per year*

*~\$6 billion lost  
due to 8/14/03  
blackout*

# Blackout Investigation

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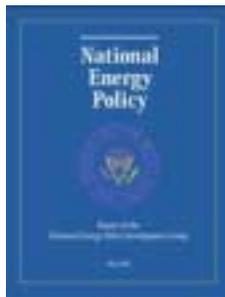
- **Working Groups**
  - Security Update
  - Nuclear Update
  - Electric System Update
- **Timing of Report**
- **Root-cause Analysis**

# Leadership from all Levels



**“...It is a plan to modernize our electricity delivery system. It is a plan which is needed now. It is needed for economic security. It is needed for national security...”**

George W. Bush February 6, 2003



May 2001



May 2002



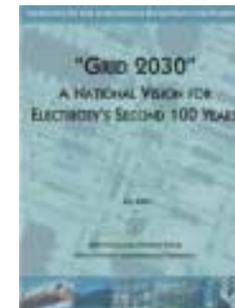
Sept 2002

Presidents Council of  
Advisors On Science  
and Technology



Report on Energy  
Efficiency  
Findings and  
Recommendations

April 2003



July 2003



Draft  
Sept 2003

**“When the lights go out, modern life as we know it grinds to a sudden halt. Transportation is interrupted, communications fail, water systems shut down, factory work is disrupted, food spoils, businesses lose money, and people are inconvenienced and even endangered. ”**

Spencer Abraham, September 3, 2003

# Electricity Modernization

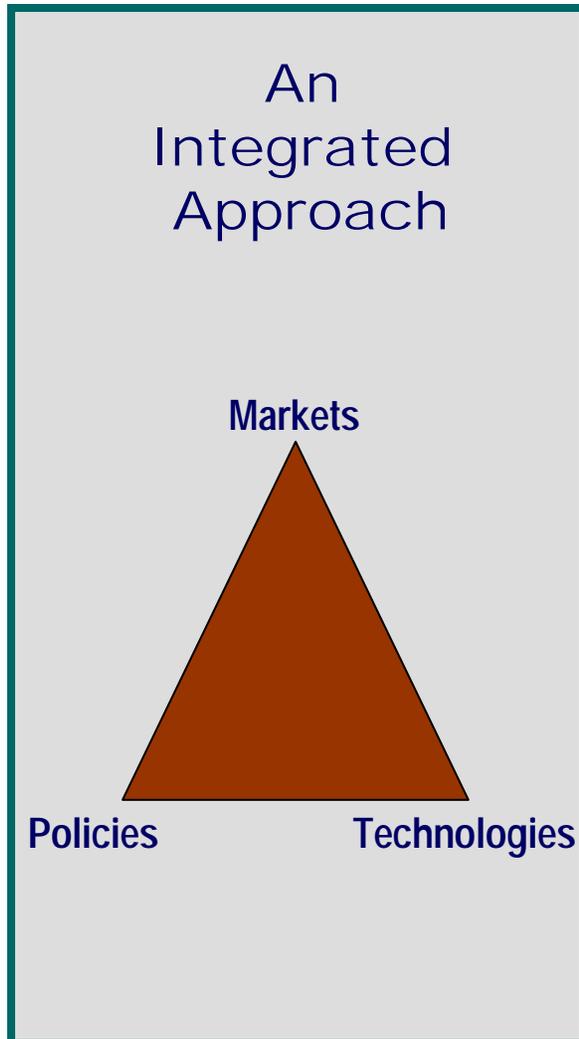


“...it's clear that the power grid needs an overhaul. It needs to be modernized. As we go into an exciting new period of American history, we want the most modern electricity grid for our people... we need more investment; we need research and development to make sure...”

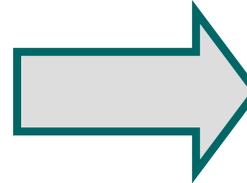


**George W. Bush**  
**September 15, 2003**

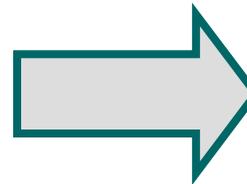
# U.S. DOE's Strategic Response



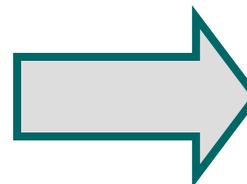
Electricity  
RD&D



Analysis,  
modeling, and  
data



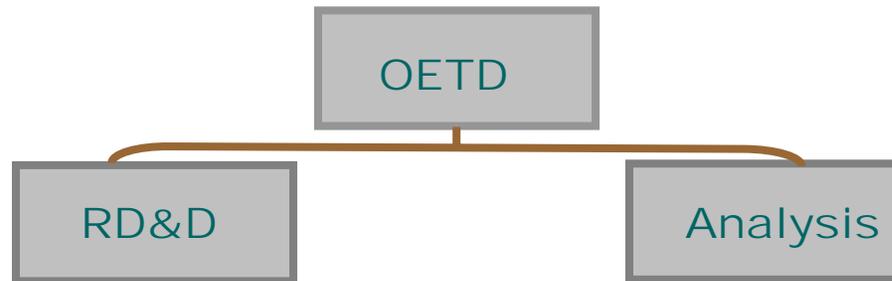
Federal,  
Regional, and  
State  
Coordination



Electricity  
Mission

*To lead a national effort to modernize and expand America's electric delivery system to ensure a more reliable and robust electricity supply, as well as economic and national security.*

# Office of of Electric T&D



## Electric Systems RD&D

- **Transmission Systems**
  - Including high capacity conductors
- **Distribution and Integration**
  - Including interconnection of distributed energy
- **Electricity Storage**
- **Superconductivity**

## Electric Power Systems Operations and Analysis

- **Electricity Policy Modeling and Analysis**
  - Provide Check/Balance to the FERC
- **Electricity Restructuring**
- **Electricity Exports**
  - Including Presidential Permits
- **Power Marketing Administration Liaison**

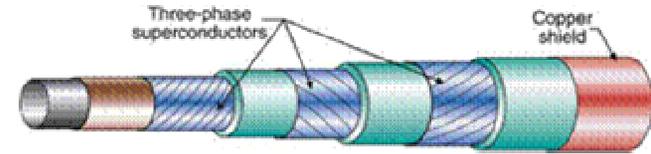
# Portfolio of RD&D



Advanced Conductors



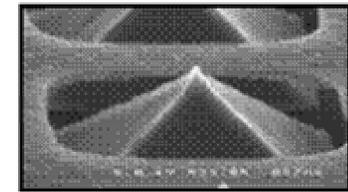
Novel storage concept



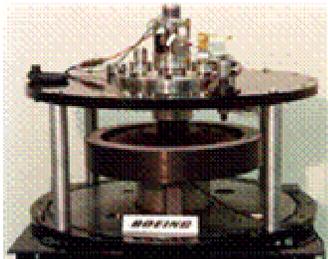
HTS tape to HTS cable



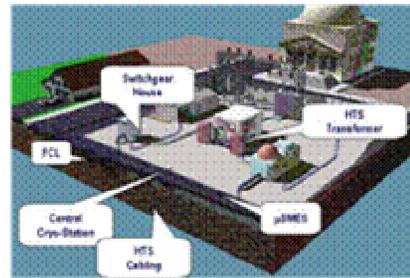
Grid-Friendly Appliance Controller



Diamond Sensor

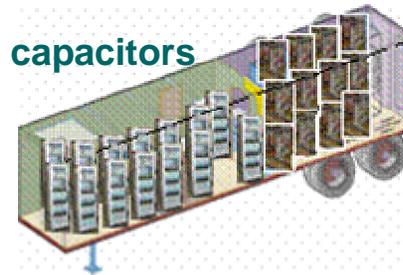


2kWh Superconductor Flywheel Demonstrator



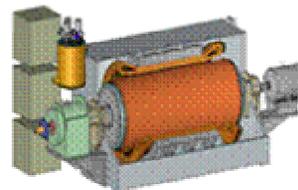
Superconducting Substation

Ultra capacitors

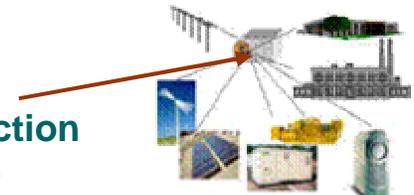


ETO DC to AC inverters

Supervar System

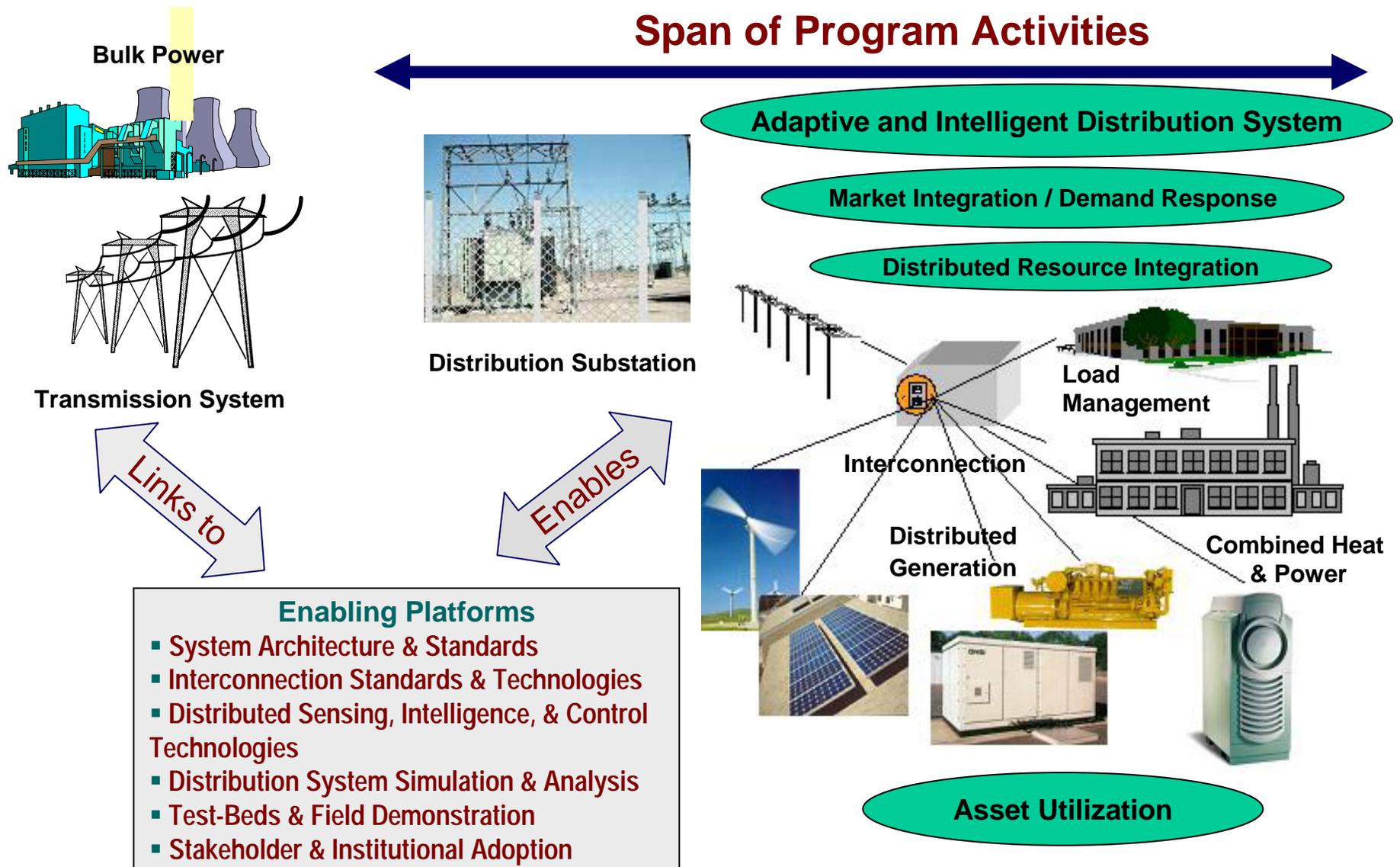


Interconnection Device

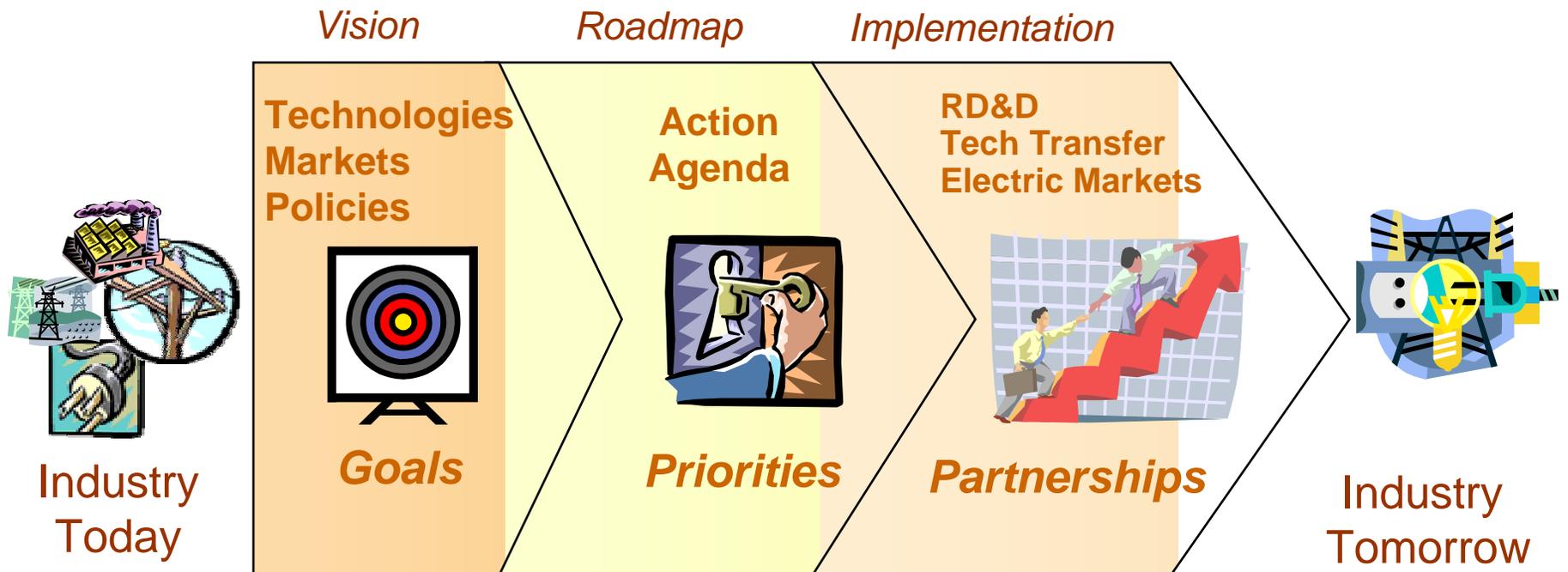




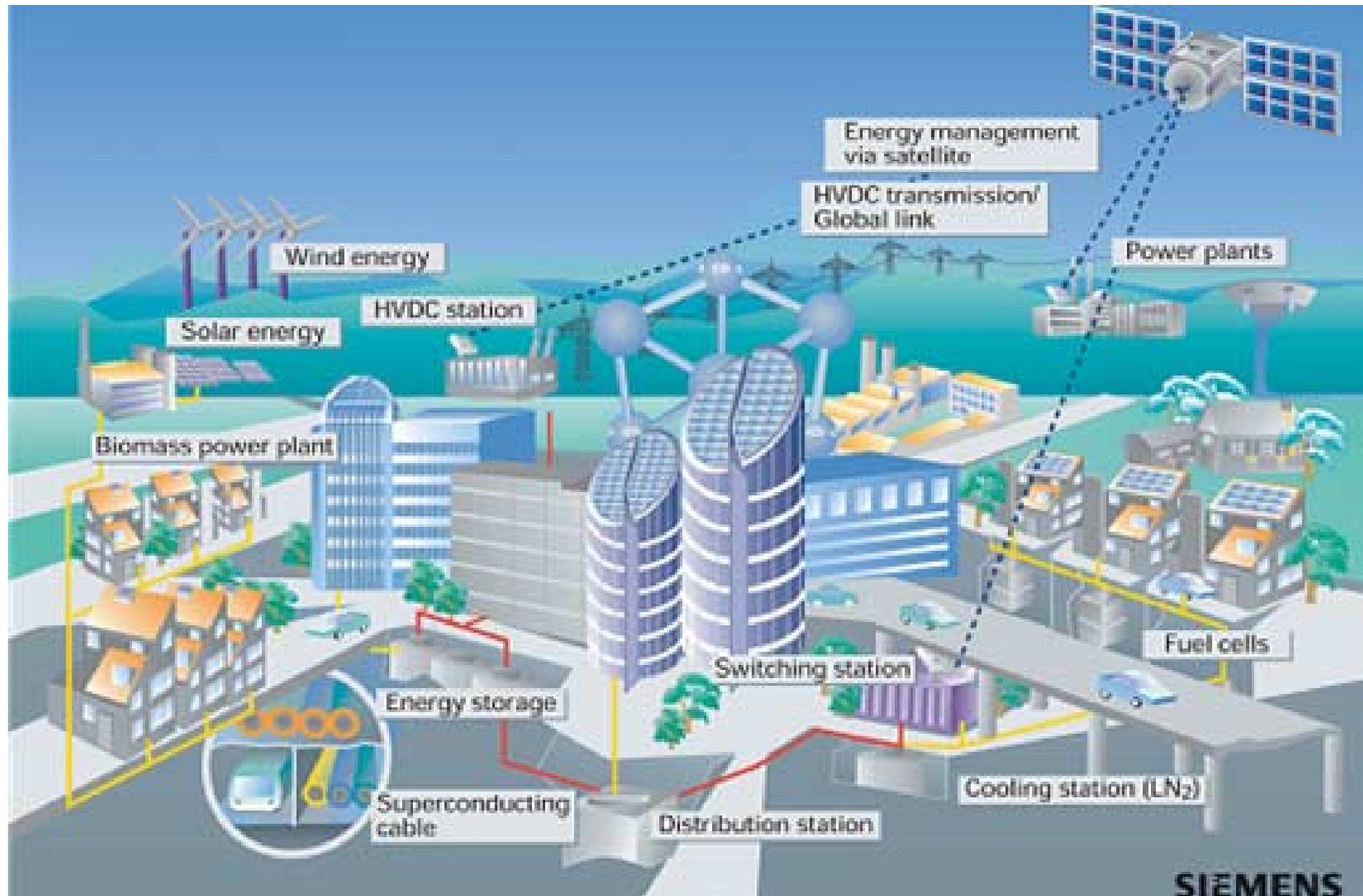
# EDT Role in the Value Chain



# National Electric Vision and Technology Roadmap



# The Vision ... "Grid 2030"



# Electric Delivery Technologies Roadmap



An Action  
Agenda  
for  
Turning  
the Vision  
into  
Reality

## Design “Grid 2030” Architecture

Conceptual framework that guides development of the electric system from transmission to end-use

## Develop Critical Technologies

Advanced conductors, electric storage, high-temperature superconductors, distributed intelligence/smart controls, and power electronics that become building blocks for “Grid 2030”

## Accelerate Technology Acceptance

Field testing and demonstrations that move the advanced technologies from the laboratory and into the “tool kit” of transmission and distribution system planners and operators

## Strengthen Market Operations

Assessing markets, planning, and operations; improving siting and permitting; and addressing regulatory barriers bring greater certainty and lower financial risks to electric transactions and investment

## Build Partnerships

Leveraging stakeholder involvement through multi-year, public-private partnerships; working with States to address shared concerns

# Public-Private Partnerships



- **Electricity Consumers**
- **Electric and Gas Utilities**
- **Independent System Operators**
- **Independent Power Producers**
- **Equipment Manufacturers**
- **IT Companies**
- **State Agencies**
- **Other Federal Agencies**
- **Canada, Mexico, and other countries**
- **Trade Associations**
- **Environmental and Labor Groups**
- **Universities**
- **National Laboratories**

# Conclusion



***“We will work to unleash innovation and strengthen our markets to allow entrepreneurs to develop a more advanced and robust transmission system that meets growing energy demand in the years ahead.”***

Secretary of Energy Spencer  
Abraham, May 8, 2002