

**GCEP 2009 Annual Meeting**

# **Technological Innovation**

## **The Cornerstone of Value**

**Jeff Keller, Ph.D.**  
**External Technology Initiatives**  
**GE Global Research Center**



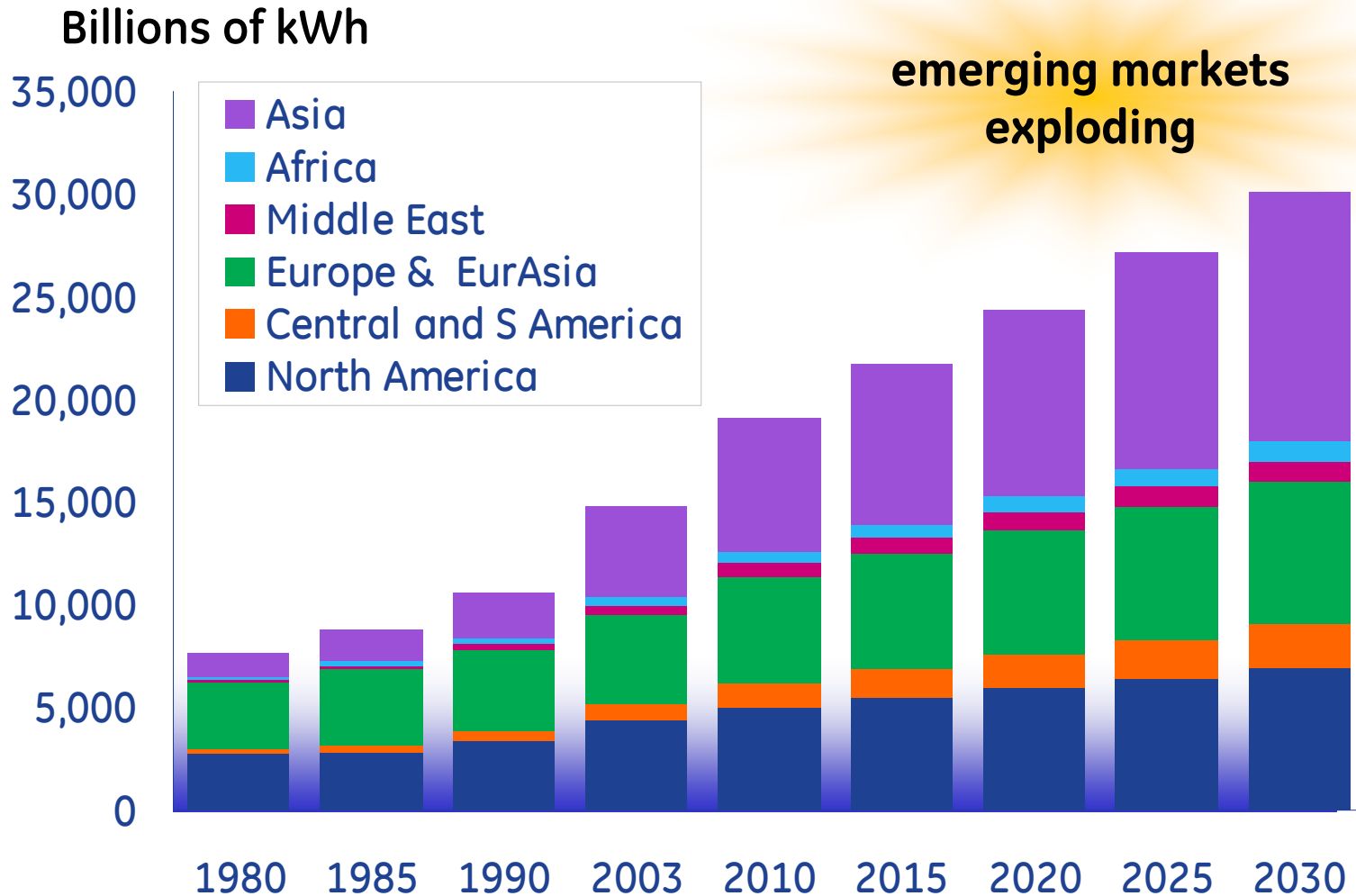
# Defining the Problem

# Falling Behind on Greentech

Jeff Immelt and John Doerr, Washington Post (8/3/2009)

- **Today's Energy Economy presents four fundamental crises:**
  - Economic
  - Climate
  - Energy Security
  - **Competitiveness**
- **China ... a fundamentally different approach**
  - Investment in cleantech
  - Commitment at scale
  - Create an industry and address CO2
- **Need:**
  - Long-term market signal: US values low-carbon energy
  - Clear rules for utilities
  - Energy standards that grow stronger over time

# Electricity demand ... +50% by 2030



Sources: EIA-DOE International Energy Annual 2004 & International Energy Outlook 2006

# Fundamental energy challenge

## Increasing demand



2007

# Fundamental energy challenge

## Increasing demand



2030

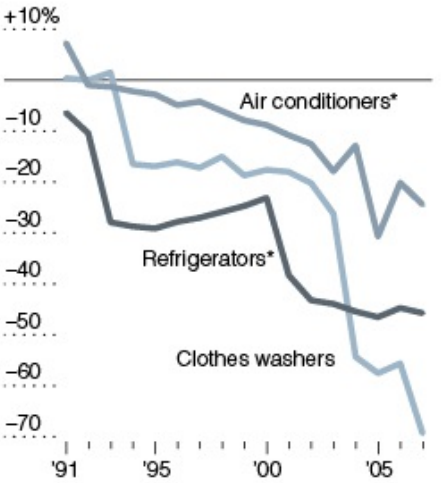
# One Step Up and Two Steps Back?

"We have entered this new era where essentially everything is on all the time"

-- Alan Meier, Lawrence Berkeley National Lab

Many appliances are more energy efficient ...

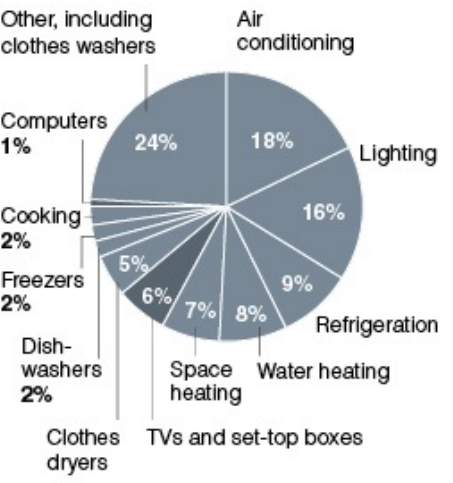
CHANGE IN ENERGY CONSUMPTION SINCE 1990



\*1998 data unavailable

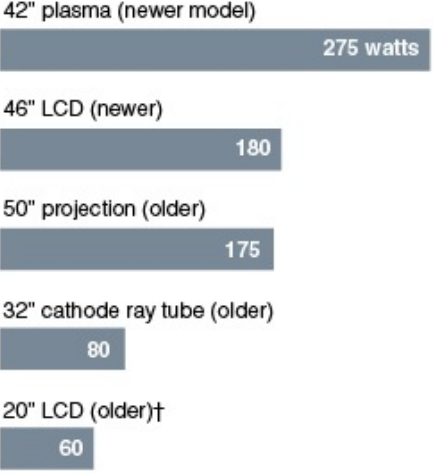
... but homes have more gadgets than before ...

AVG. U.S. RESIDENTIAL CONSUMPTION, 2005



... and new TVs are bigger energy users ...

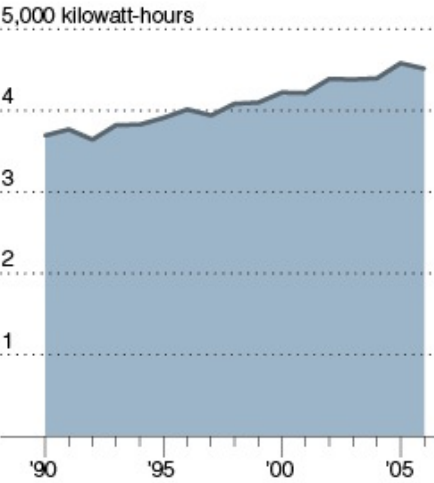
EST. AVG. POWER USAGE FOR TV MODELS



†The technology is popular, but people usually buy bigger models now.

... which is causing consumption to rise.

U.S. PER CAPITA ELECTRICITY CONSUMPTION



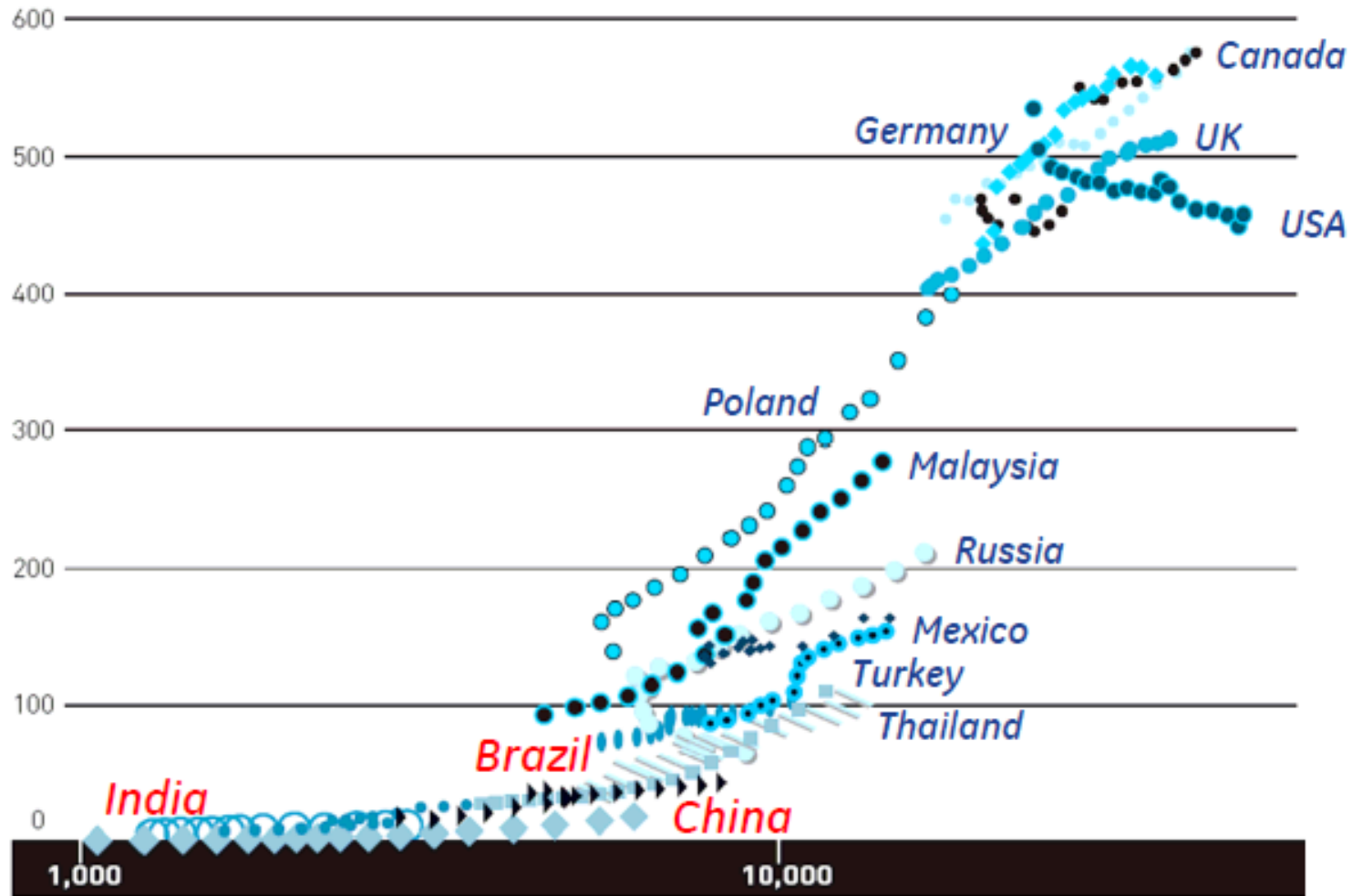
Sources: International Energy Agency (per capita consumption and energy use by appliance); Association of Home Appliance Manufacturers (decrease in consumption for some appliances); Ecos (TV power usage) THE NEW YORK TIMES

Source: New York Times



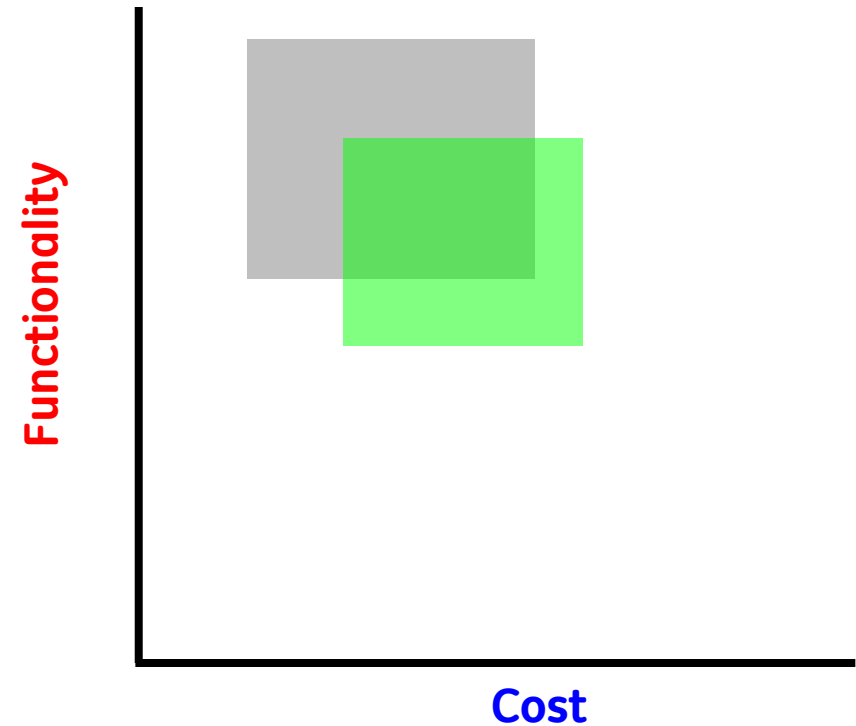
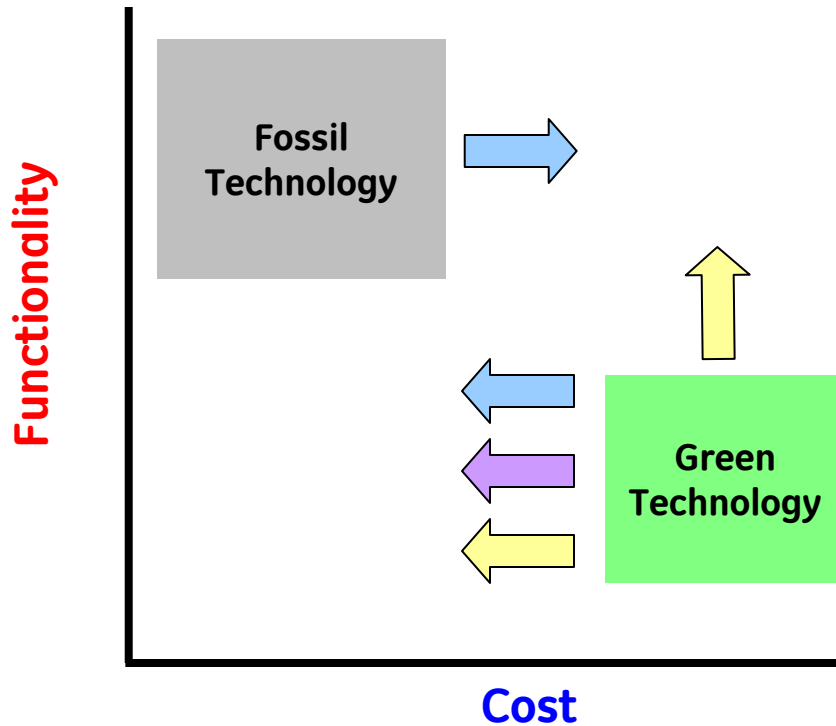
# Profound Drivers for Oil and Transport

Personal Mobility Demand... \$10K GDP/Capita Threshold  
Cars per 1,000 people versus GDP per Capita (logarithmic scale), 1990-2008



# How Do We Go Forward?

- **Green technologies will appear inferior until...**
  - Carbon is counted ... **policy** ( → )
  - **Commercialization capability** ( → ) adapts and matures
  - Technologies advance and mature ... **innovation** ( → )



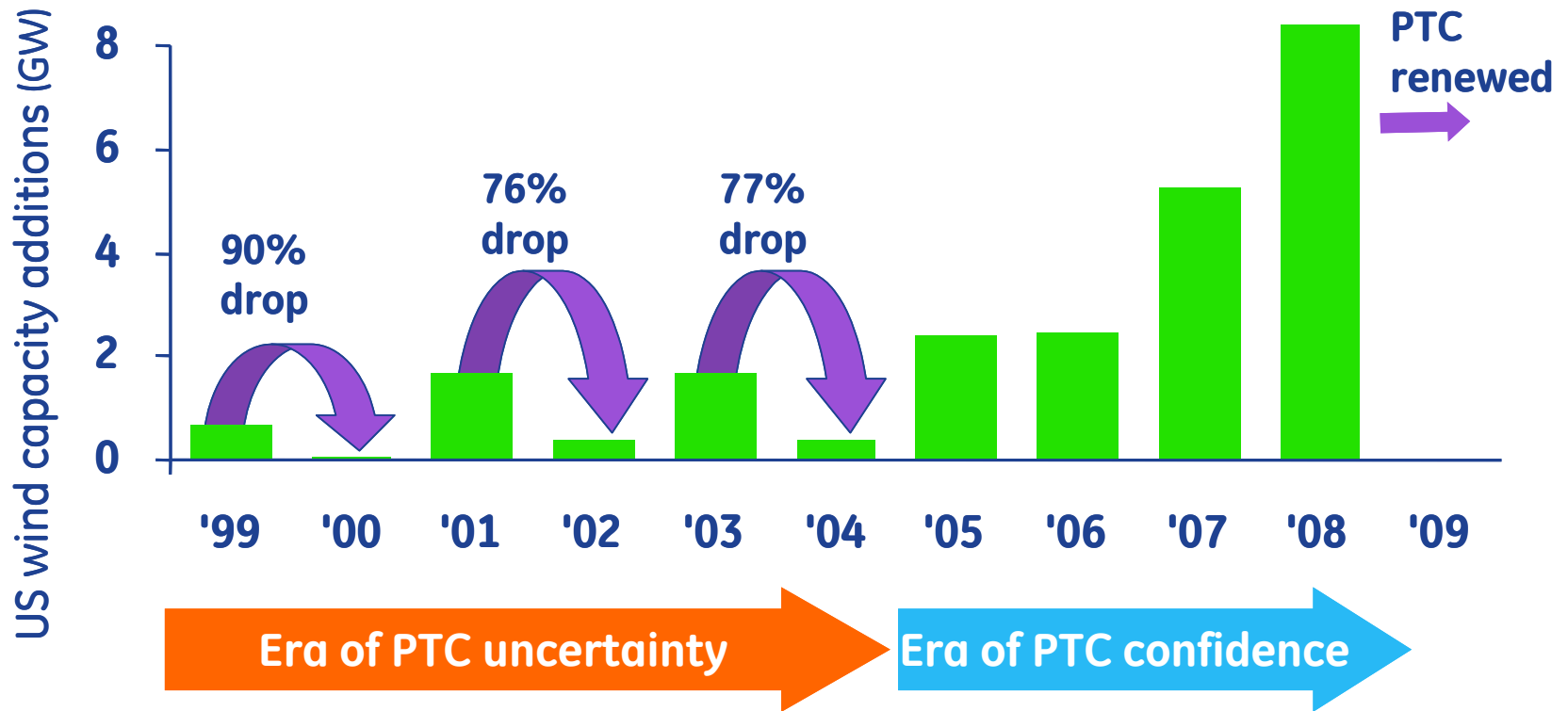
# What Would a Solution Look Like?

## How Does GE Help?

# What Would a Solution Look Like?

## Policy

- “Long term signal that U.S. values low carbon energy”  
-- Immelt and Doerr



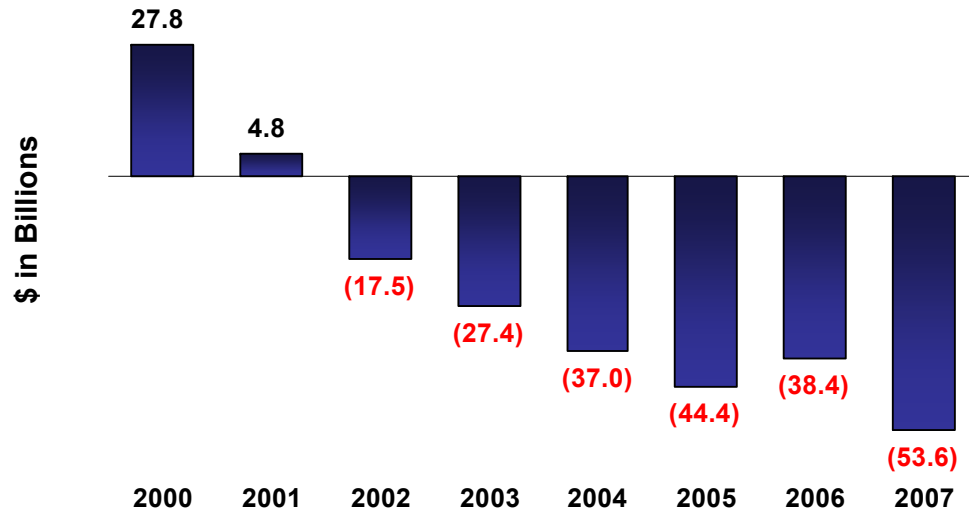
Sources: American Wind Energy Association, Lawrence Berkeley Lab

# What Would a Solution Look Like?

## Commercial Capability

- Restore and invest in “Industrial Commons<sup>1</sup>”
- Loss of infrastructure leads to loss of innovation

### Loss of Industrial Commons U.S. Trade Deficits in High Tech Products



### GE in Michigan Advanced Manufacturing and Software Technology Center

Future MTC Bldg 50 Bldg 40 Bldg 45



Visteon Village, Van Buren Township

SITE PLAN



Source: National Science Board, “Science and Engineering Indicators 2008”

Footnote: (1) Pisano & Shih, Harvard Business Review, July-August 2009



imagination at work



# What Would a Solution Look Like?

## Innovation

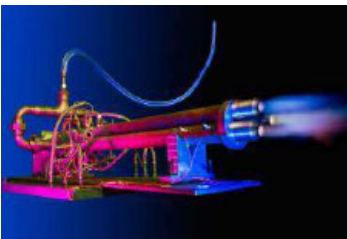
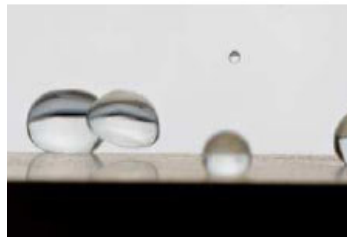
### Technology for Today...



**Nuclear**  
**Coal**  
**Gas**  
**Wind**  
**Oil**  
**Geothermal**  
**Biomass**  
**Hydro**  
**Solar**



### ... and the Future



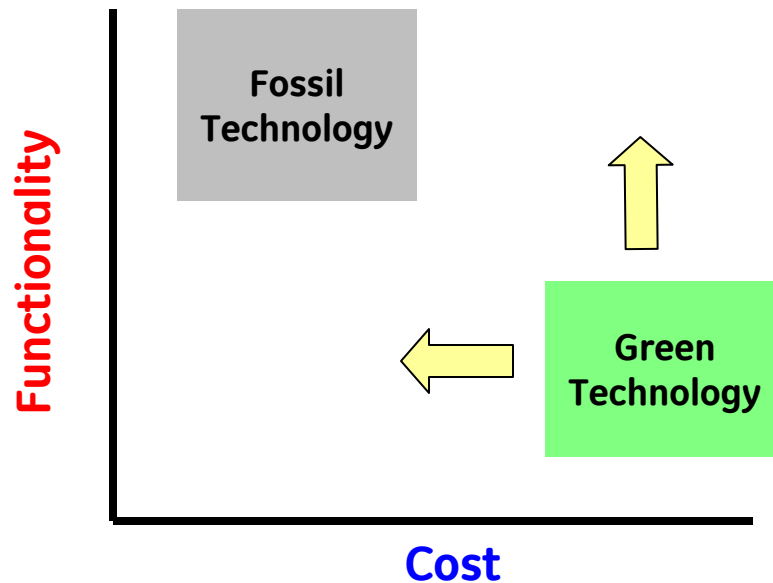
**Nanotechnology**  
**Sustainable Energy**  
**Molecular Imaging and Diagnostics**  
**Electronic Materials Systems**  
**Advanced Propulsion**  
**Energy Conversion**

**Extending 125 years of technology leadership**

# What Would a Solution Look Like?

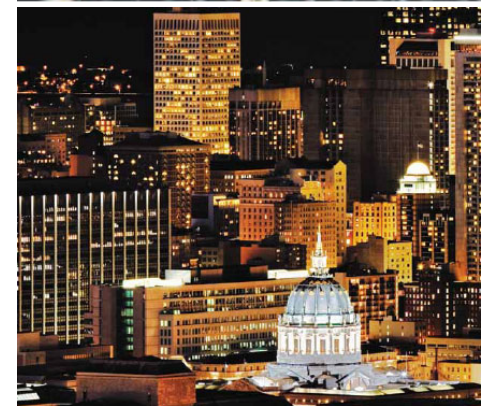
## Innovation

- Restore strength of funding for basic and applied research
- Bear the costs of high risk, high reward research collectively
- What you'll hear over the next few days...



# Concluding Thoughts

- Energy is the defining issue of our time
- Four crises, One solution
- Technology is the most powerful tool we have
- Basic research is a necessity if we're to meet the challenges ahead
- Inflection point for U.S. economy: how we proceed in coming years will define our trajectory for a century



# Thank You

