

# Opportunities in a Carbon Constrained World

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ENERGY STAR® Program

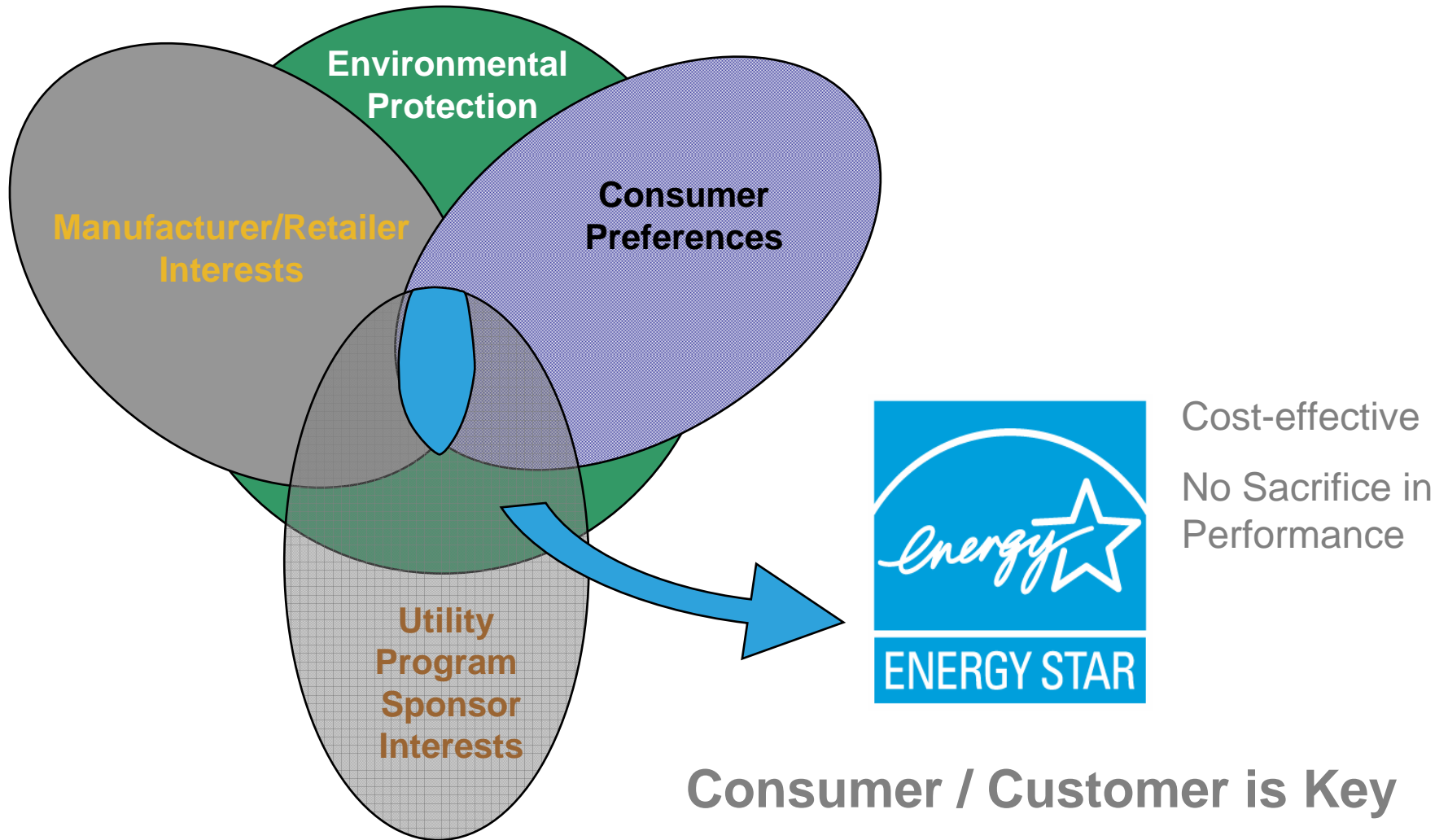
[www.energystar.gov/datacenters](http://www.energystar.gov/datacenters)



# Navigating Our Environmental Future



# The ENERGY STAR Mission Requires Finding & Building Upon an Intersection of Interests



# Defining Energy Efficiency the ENERGY STAR<sup>®</sup> Way



- A voluntary public-private partnership
- A strategic approach to energy management
- Recognized by over 70% of Americans
- An internationally recognized brand
  - Recognized in Australia, Canada, Europe & Japan

# ENERGY STAR

## Market Sector Coverage



### Residential

#### Labeled Products

- for plug loads not system
- 50+ products / 1700 manufacturers
- 10-60% more efficient

#### Labeled New Homes

- 30% more efficient

#### Home Improvement

#### Services

- beyond products
- air ducts / home sealing
- whole home retrofits



### Commercial / Industrial

#### Corporate energy management

- benchmarking, goals, upgrades management, systems
- whole building labeling for excellence
- technical assistance

#### Industrial

- 10 industries

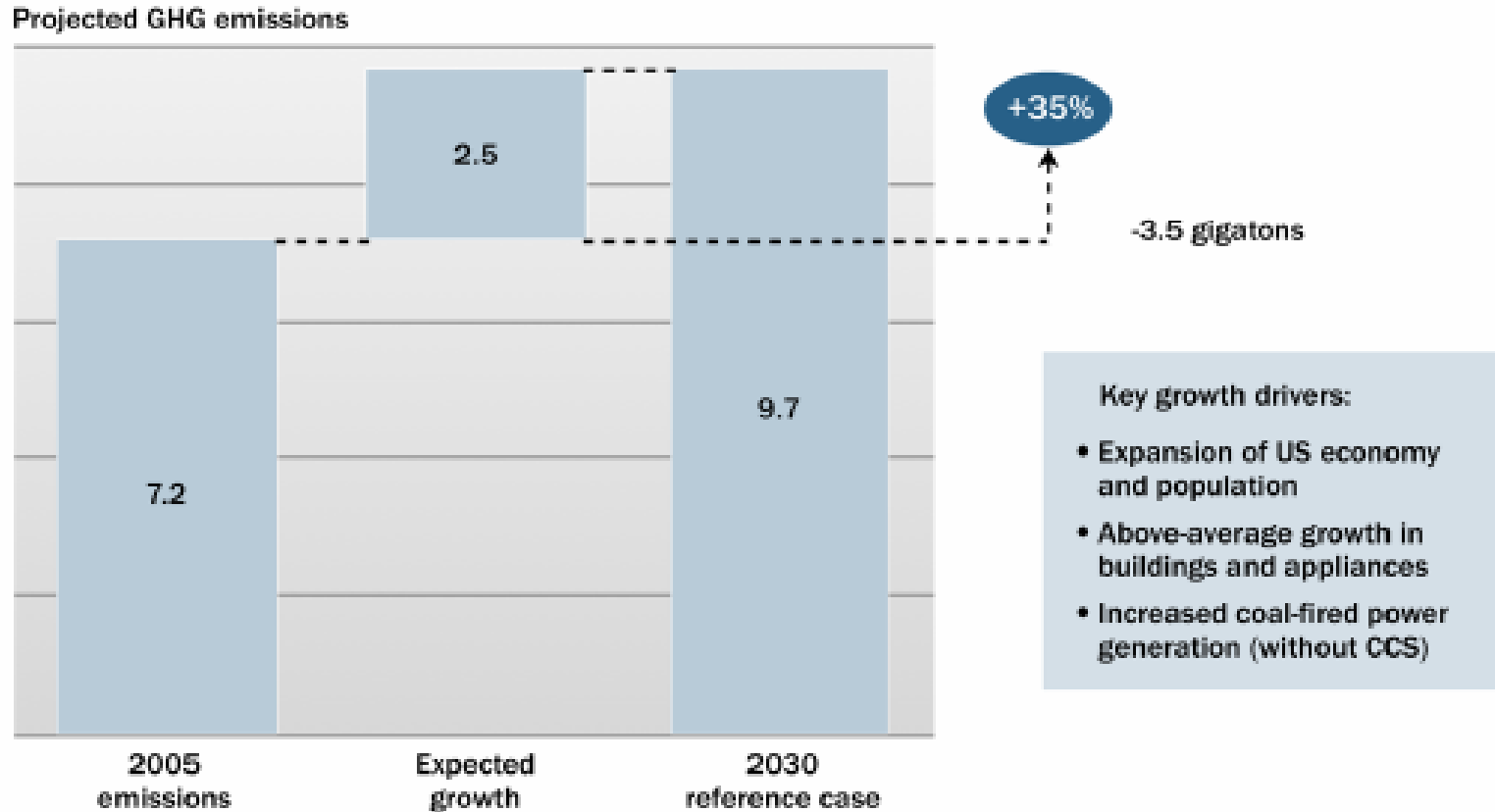
#### Small business initiative

**\* Datacenters addressed by labeled products & corporate energy mgnt.**

**International partnership agreements with 7 countries**

# GOVERNMENT AGENCIES FORECAST US EMISSIONS TO RISE 35% BY 2030...

Gigatons CO<sub>2</sub>e per year

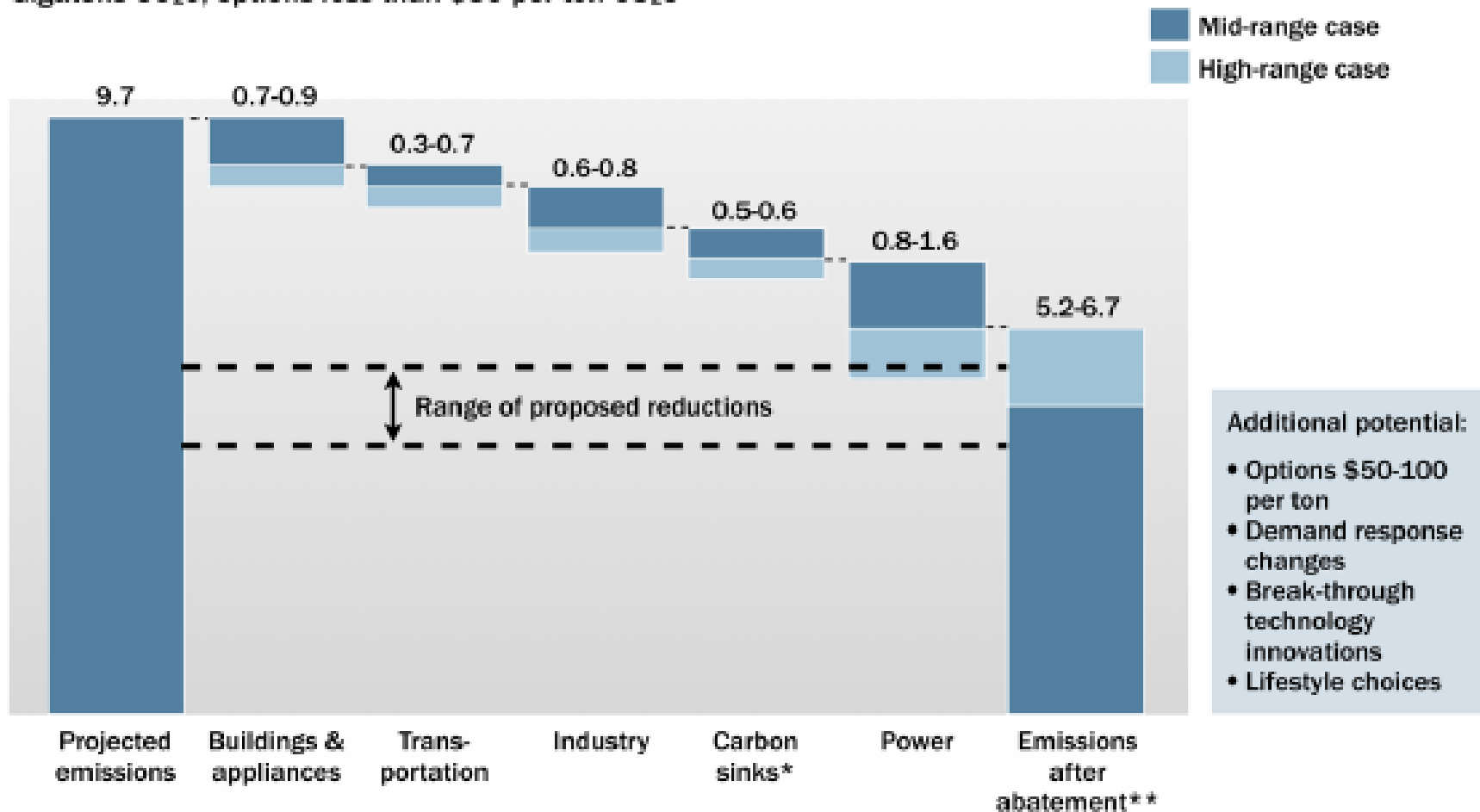


\* Based on bills introduced in Congress that address climate change and/or GHG emissions on an economy-wide basis and have quantifiable targets

Source: U.S. EIA Annual Energy Outlook (2007) "Reference case," U.S. EPA; Pew Center On Global Climate Change; McKinsey analysis

## FIVE “CLUSTERS” OFFER SIGNIFICANT POTENTIAL

Gigatons CO<sub>2</sub>e, options less than \$50 per ton CO<sub>2</sub>e

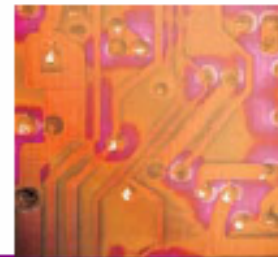
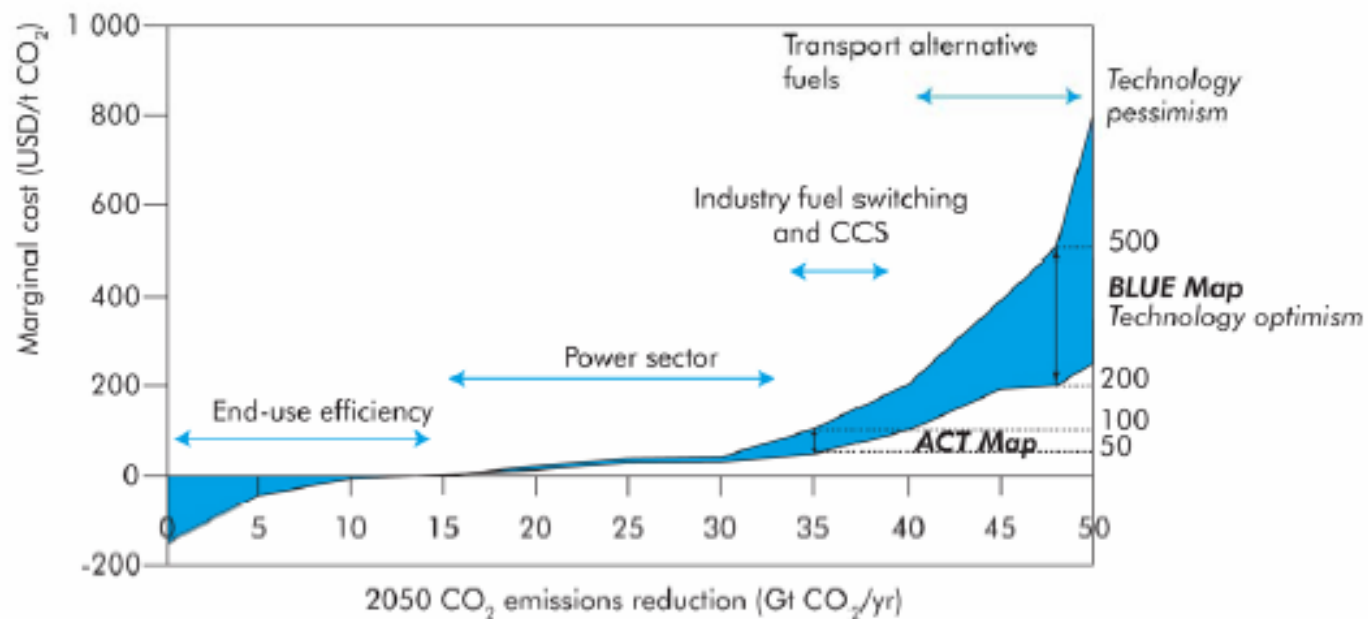


\*Including abatement in the agriculture sector beyond expanding carbon sinks

\*\*Adjusted for cumulative rounding errors

Source: U.S. EIA, EPA, USDA, McKinsey analysis

# Marginal emission reduction costs for the global energy system, 2050



ENERGY  
TECHNOLOGY  
PERSPECTIVES  
2008

Scenarios &  
Strategies  
to 2050



INTERNATIONAL  
ENERGY  
AGENCY

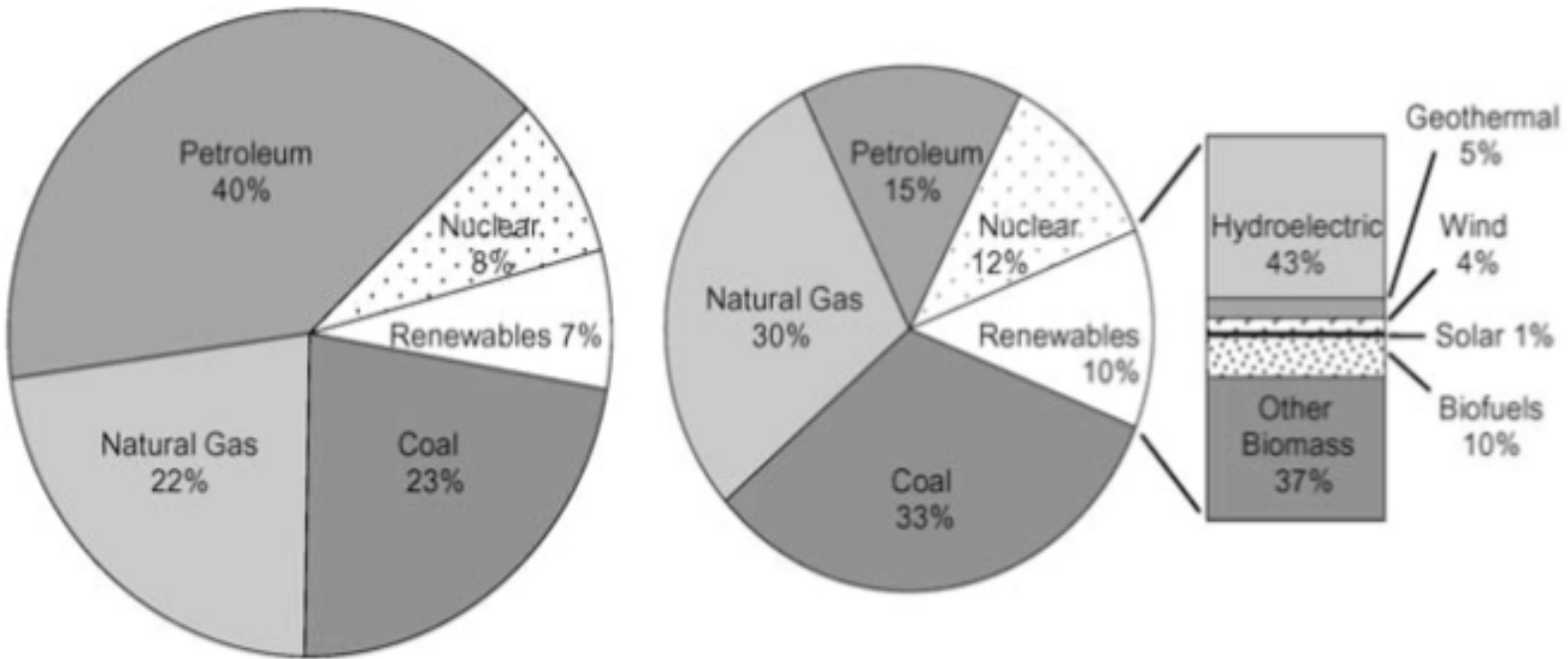




# Now the US is a major importer of oil and tiny user of newer renewables

Chart 7-1 U.S. Energy Consumption and Production (2006)

Fossil fuels accounted for the majority of U.S. energy consumption and production in 2006.

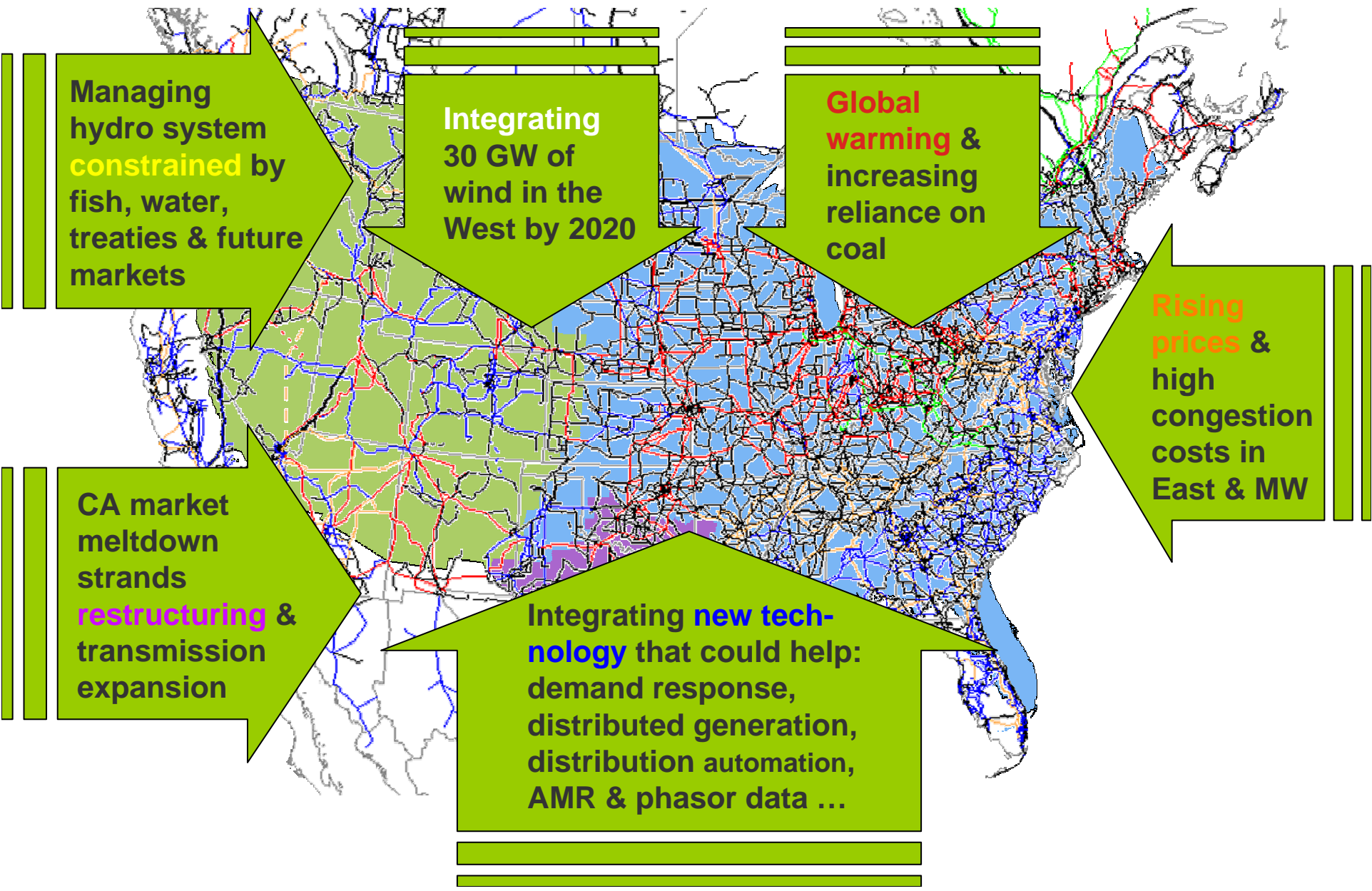


Total Consumption: 100 Quadrillion Btus

Total Production: 71 Quadrillion Btus

Source: Department of Energy (Energy Information Administration).

# We are facing large transmission & generation investments in an uncertain economic environment



QuickTime™ and a  
TIFF (LZW) decompressor  
are needed to see this picture.

# Key Findings of EPA Report to US Congress One Year Ago



Scenario	Electricity Consumption	Electricity Costs	Environmental Impact
<b>Today (2006)</b>	Use about 61 billion kWh Doubled since 2000 1.5% of total U.S. consumed More than U.S. TVs Equivalent to 5.8 million average U.S. households	Costs \$4.5 billion annually	Peak load on power grid is equivalent to the output of 15 power plants
<b>Current Trends (by 2011)</b>	Use nearly doubles to more than 100 billion kWh	Costs \$7.4 billion annually	Requires an additional 10 power plants, more at peak periods
<b>EPA Scenarios (by 2011)</b>	Annual savings of approximately 23 billion to 74 billion kWh over current trends	Reduces costs by \$1.6 billion to \$5.1 billion annually	Reduces peak load by equivalent of up to 15 new power plants Reduces 15 to 47 MMTCO <sub>2</sub>

# 2008: What's Changed?

## Big Picture Observations, Trends & Responses

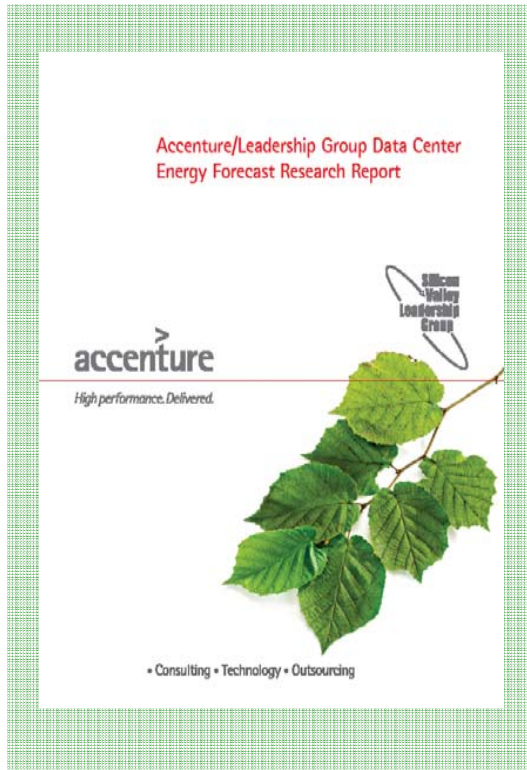
- Biggest data center construction boom in history
- Higher power density is pushing electricity consumption to grow faster than the number of servers\*
  - Almost 0.5% of world electricity production
  - Doubling from 2000-2006
  - CO<sup>2</sup> emissions projected to quadruple from 170 Mt to 670 Mt
  - Emissions expected to surpass Airlines by 2020\*
- Incremental US energy demand between 2008 & 2010 equal to 10 new power plants (more at peak) -- at a time when few new plants are being built
- Operations mgmt. not keeping up with growing DC complexity & accelerating energy use
- 90% of companies running large DCs need more power and cooling in the next 30 months\*
- Growing recognition of need for financial tools to understand impacts on OPx and CAPx from energy consumption

\*Source: Ken Brill, The Uptime Institute [www.uptimeinstitute.org](http://www.uptimeinstitute.org)

# Results from Accenture Silicon Valley Leadership Group Report

This report is a follow on to the EPA report to answer the EPA's call to action

***“Objective, credible information is needed about the performance of new technologies and about best practices as well as the effect of both on data center availability”***



Compares the energy estimates of the EPA report with measured results

- To encourage increased adoption of energy saving initiatives
- To help shape potential standardization, regulation, or certification around energy use
- To demonstrate commitment of data center operators to environmental responsibility

# 3 Strategies for Driving EE

- **Define** energy efficient data centers
  - Benchmarks and common worldwide metrics are essential
- **Advance** energy efficient data centers
  - Employ methods and management systems to continually improve over the long term
- **Reward** energy efficient data centers
  - Use public recognition and monetary incentives

# Defining EE Data Centers:

## US EPA Activity # 1

- ESTAR Datacenter Benchmark Development – Initiated data gathering effort for more than 240 DCs
- What is ENERGY STAR for Buildings?
  - U.S. Government sponsored energy management program providing proven solutions to help public and private sector building owners/managers reduce energy consumption
  - Over **3,000 Partners** operating more than **11 billion sf** (nearly 20% of space in the US)
  - More than **62,000 buildings** measure and track their energy performance using ENERGY STAR's Portfolio Manager on-line tool



# Defining EE Data Centers: ENERGY STAR Rating Goals

- Build on existing ENERGY STAR platform with methodology similar to existing ratings (1-100 scale)
- Usable for both stand-alone data centers and data centers housed within office or other buildings
- Assess performance at building level to explain how a building performs, not why it performs a certain way
- Provide users with additional resources to help determine next steps after receiving an energy performance rating
- Offer the ENERGY STAR label to data centers with a rating of 75 or higher

# ENERGY STAR Data Center Infrastructure Rating Development

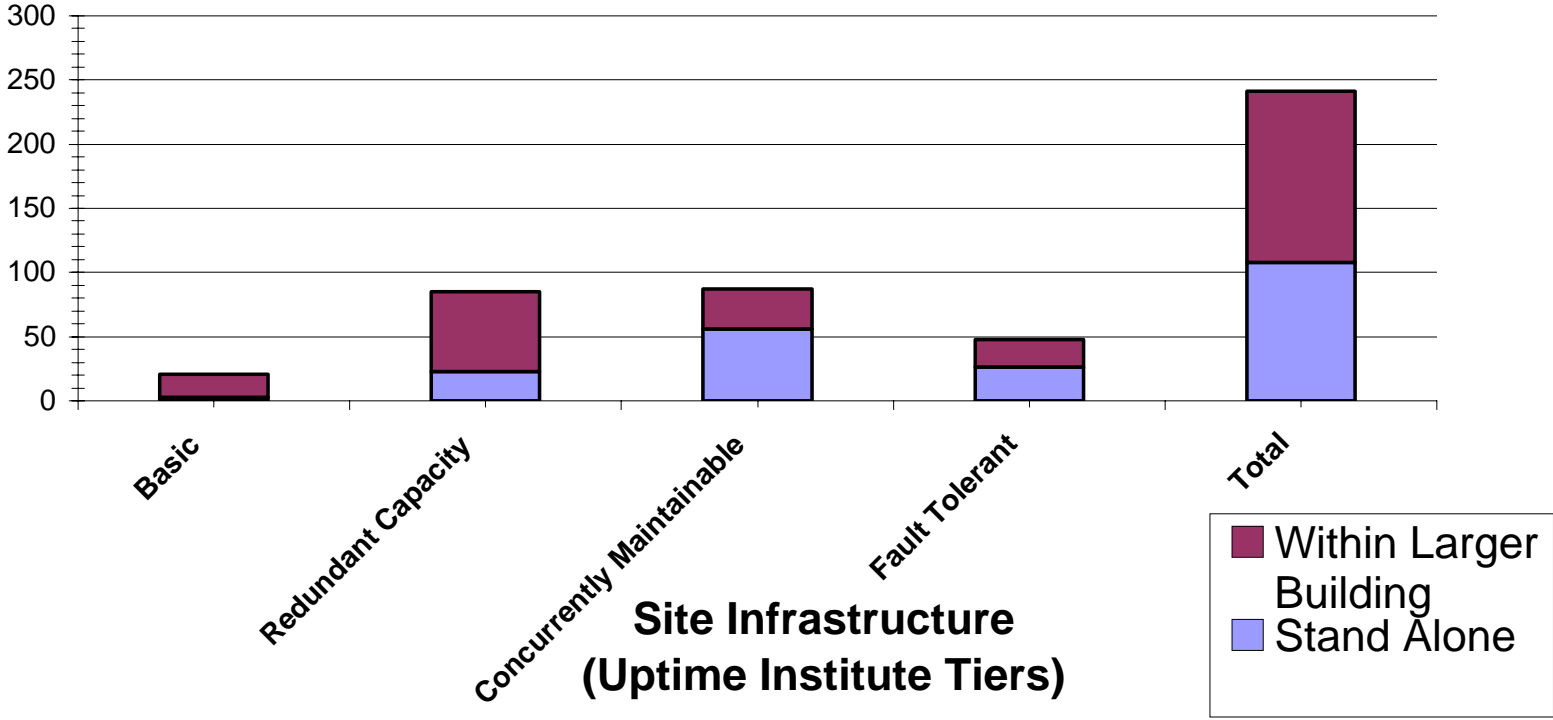
(Profile of Participating Datacenters)

- # of Companies - 126
- # of DCs - 241
- Total ft<sup>2</sup> - 17,693,371

Location by EPA Region	
Region 1	13
Region 2	42
Region 3	30
Region 4	19
Region 5	26
Region 6	23
Region 7	9
Region 8	12
Region 9	43
Region 10	15
International	10

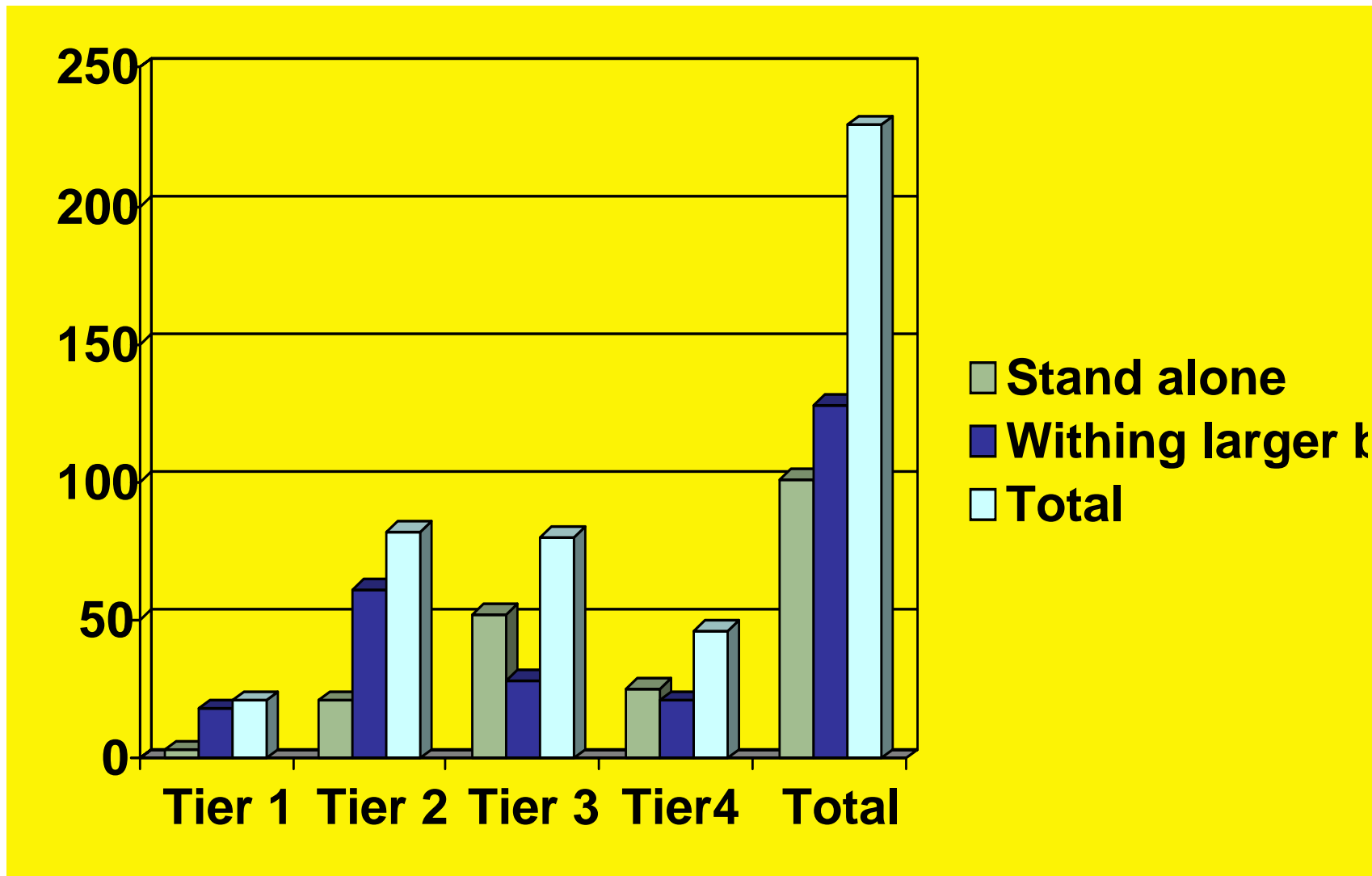
# ENERGY STAR Data Center Infrastructure Rating Development

Participating Datacenters  
by Building Type

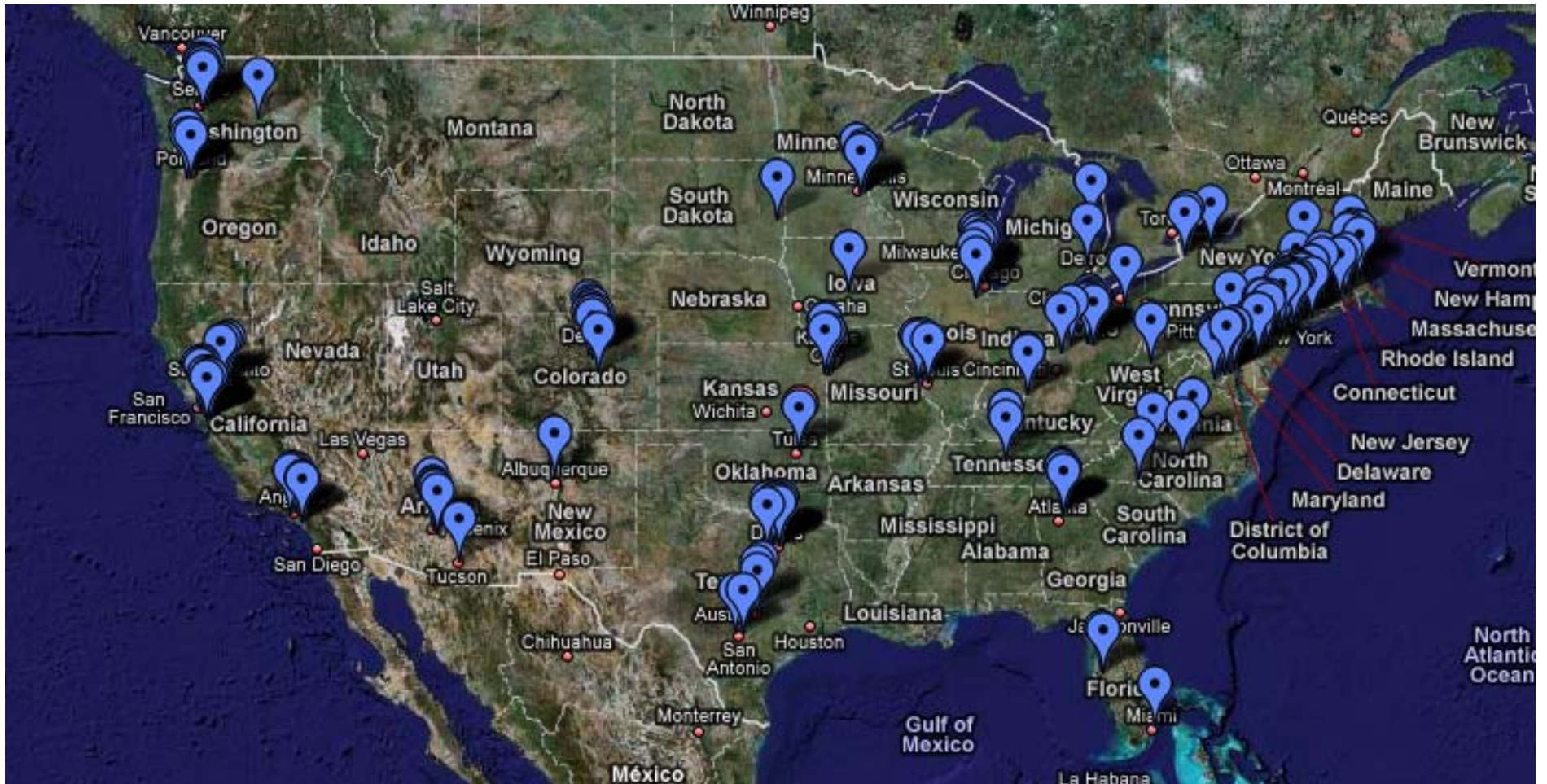


# Participating DCs by Building Type

(as Defined by Uptime Institute)



# Participating Datacenters



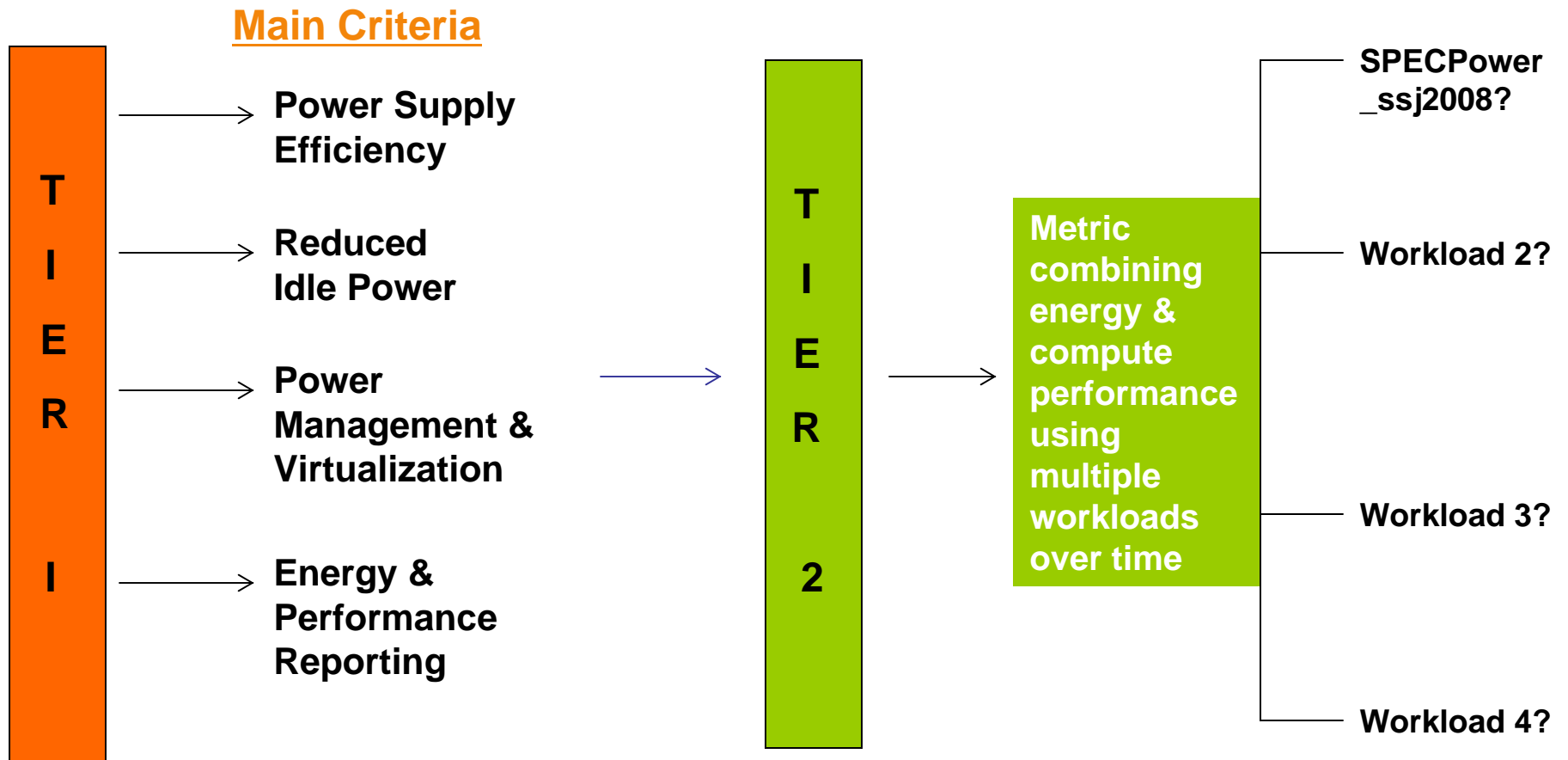
# Rewarding EE Data Centers: Data Collection & Rating Development Process

- July 1, 2008
  - Data center operators begin collecting data
- August 15, 2008
  - EPA collects first data & then monthly
- Quarterly 2008 – 2009
  - EPA holds progress report webinar
- End of 2008
  - Mid-year analysis of data
- January 2010: EPA launches rating in Portfolio Manager (subject to change)

# Implementation Timeline for ENERGY STAR Servers

- **Draft 2** – August 2008
  - Subsequent drafts as needed
    - Tier 2 development workgroup initiated - Fall 2008
  - **Final Tier 1 Spec effective – January 2009**
    - Will include roadmap for future tier 2
  - **Tier 2** transition 12 to 18 months after tier 1 is sunset
- Q4 Possible announcement on research into data storage and networking equipment for possible ESTAR product specs

# The Long Term Vision for an ENERGY STAR Server Specification



## Projected Effective Date Timeline

**Tier 1 - January 2009 to be followed by Tier 2 / 12 - 18 months later**



# Scope of Coverage for ENERGY STAR for Servers

## Server Characteristics

- Volume/Mid-Range
- Blades & Chassis
- AC-DC/DC-DC units
- Marketed/sold as server
- Server OS and/or Hypervisors
- 1+ processors/sockets
- Dedicated Mgmt Controller (service processor)
- RASM features
- ECC and/or buffered memory (DIMMS, BOB)

## Other Computers

- Laptops
- Desktops
- Workstations

## Outside of Scope

- Networking & storage equipment
- High Performance (> 4 processor) servers not eligible to be covered at this time

# Product Development Guiding Principles



*Server graphic courtesy of Sun Microsystems*

# Possible To Do List

- Share key building & product contacts
  - Organize conf. call to discuss roadmap for cooperation
  - Coordinate with Bruce Nordman [bnordman@lbl.gov](mailto:bnordman@lbl.gov)
- Collect energy and performance data for buildings and products from the field (i.e. real world conditions)
  - Collaborate with other industry stakeholders on basic test procedures to be used
- Prepare basic report on industry background to share with EPA/DOE and to establish interest in cooperation
  - Products, building types, markets, technology etc.
- Plan possible workshop at industry event in Q1 to discuss issues and opportunities
- DOE also interested in telecom facilities.
  - October workshop being planned. Contact:  
KC Mares 408-203-8638 [KCMares@MegaWattConsulting.com](mailto:KCMares@MegaWattConsulting.com)

# Final Take Aways

1. We are waking up to the pervasive nature of our carbon based economy and lifestyle
2. Grappling with energy supply, energy distribution & climate challenges will profoundly change the way we live and work
3. High probability that electricity, regardless of source, will be more expensive - addressing climate change will add to this
4. Increasingly, investors, customers and regulators are demanding disclosure of energy use and emissions risk
5. Investment in efficient product design & best operational practices for buildings will be a competitive key and business norm
6. Datacenters are vital national infrastructure and key energy efficiency opportunities
7. Energy efficiency is the cheapest, cleanest, quickest strategy to implement -- complementary to all other strategies

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