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NGDC
San Francisco CA

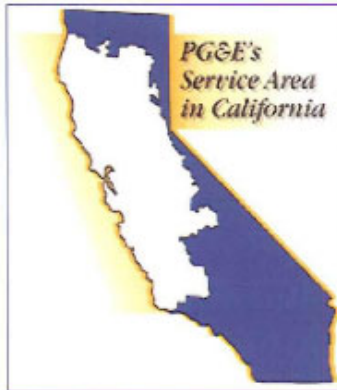
Utility Leadership for Data Centers and IT

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*Pacific Gas and
Electric Company®*

Pacific Gas and Electric Company (PG&E)



- \$18 B+ Market Capitalization
- 20,000 Employees
- Provides energy to 15 million or nearly 1 in 20 people in the U.S.
- 70,000 square-mile service territory
- More than half of our electricity comes from sources that emit no CO2

Electric and gas distribution customers	5.0 MM electric 4.2 MM gas
Electric transmission circuits	18,616 miles
Electric distribution circuits	120,000 miles
Gas transmission backbone	6,128 miles
Gas distribution	40,123 miles
Electric generation capacity	6,420 MW
Nuclear (1), Fossil (2), Hydro (110) Plants	22,544 Peak MW

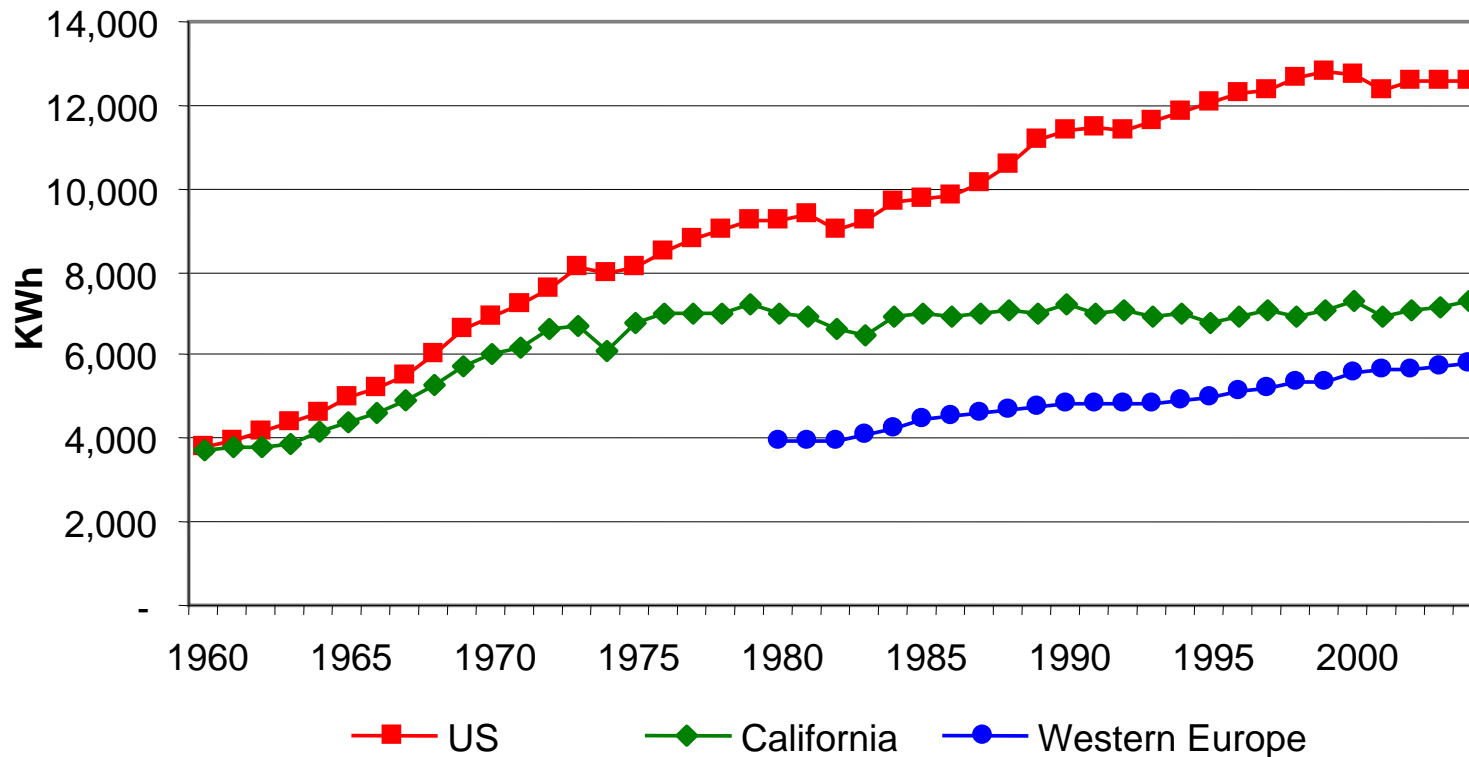
- ▶ Why is PG&E helping customers to use less energy
- ▶ What is driving the emphasis on energy efficiency in the Information Technology/Data Center sector
- ▶ What programs and services has PG&E developed
- ▶ Broader opportunities
- ▶ Getting there: a leadership challenge.

Why Energy Efficiency?

- ▶ Our customers expect/love the programs
- ▶ All customers benefit through lower rates
- ▶ PG&E benefits financially
- ▶ Energy efficiency is the cornerstone of our commitment to environmental responsibility and quality

30 Years of Energy Efficiency Success

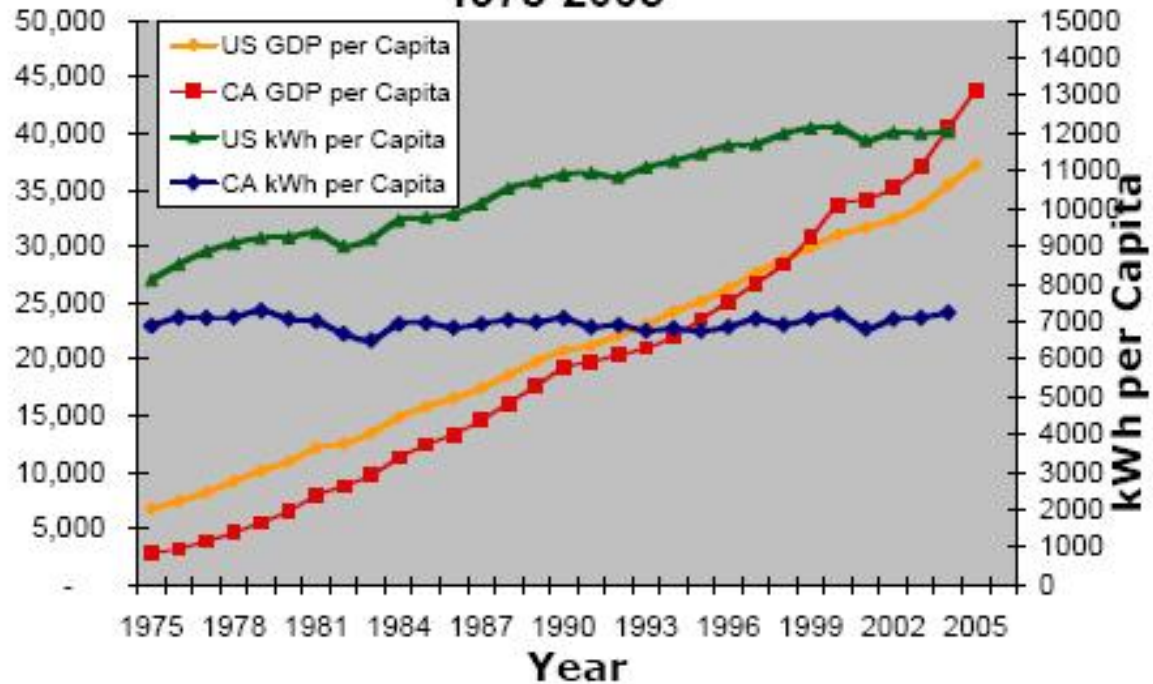
- Energy efficiency programs have helped keep per capita electricity consumption in California flat over the past 30 years
- PG&E's programs alone have avoided the release of over 1 million tons of CO2 into the atmosphere over the same period, equivalent to taking 8.6 million cars off the road for a year





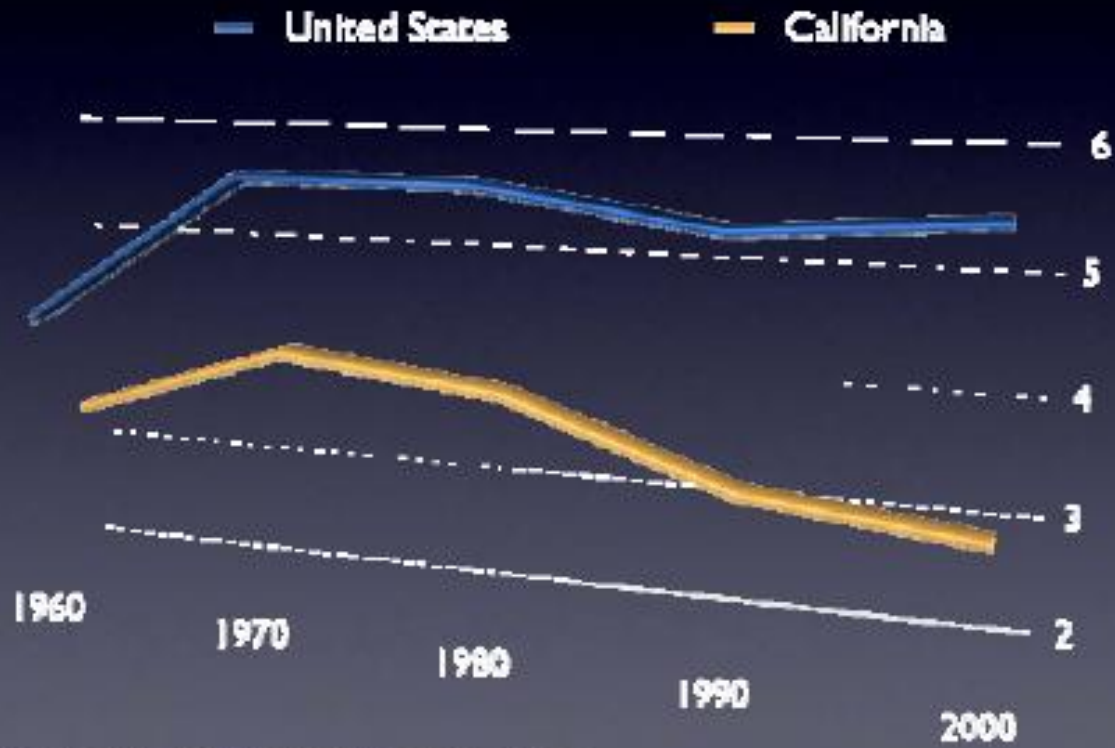
California Energy Commission

Energy Efficiency and Economic Growth 1975-2005



Per Capita Carbon Emission Rates

Metric Tons of Carbon



Source: ORNL Carbon Dioxide Information Analysis Center



Our Direct Market

- ▶ A total load of 400–500 MW (2.5% of total, compared to 1.2% nationally)
- ▶ “Enterprise” centers are known (stand-alone and co-location)
- ▶ “Corporate” centers are hidden in office buildings and campuses
- ▶ “Closets” are invisible
- ▶ The key challenge for enterprise and some corporate data centers is space, cooling, and power supply constraints, in the face of...



Intense Growth Rates...

- ▶ IT workload growth is multiples of GDP for most companies, and can be 10x for some sectors (financial services, web businesses)
- ▶ All companies facing huge growth rates in data storage (50 to 100% annual growth not uncommon)
- ▶ When your back is up against the wall for IT capacity, you might consider...

...An "Instant" Data Center





Data Center Facility

- Premium efficiency cooling equipment
- Variable frequency drives and controls for cooling equipment
- Free-cooling strategies
- Airflow containment
- Airflow management and control
- Premium efficiency power conditioning
- High voltage power distribution
- Tech support to evaluate projects

Data Center IT

- Virtualization and consolidation of servers and data storage
- Data storage thin provisioning
- MAID systems

Desktop

- Premium efficiency (EnergyStar/80 Plus) personal computers (Upstream rebate)
- Network power management of desktops (rebate)
- Premium efficiency LCD monitors (Upstream rebate)
- Desktop thin client

Under Development

- Data storage systems with disc management
- Rebate program for premium power supplies for data center IT equipment
- Rebate program for desktop thin client

Consolidation So Promising...



Consolidation So Promising...





EE Program Hurdles

Market Size – How much savings potential?

Standard Efficiency Metric/Test Method?

Can Savings Be Accurately Characterized?

Market Adoption Rate – Nascent, Mature, Growing?

Will Savings Be Persistent?

Accepted Baseline/Standard Efficiency?

Cost Effectiveness

Will Incentives Move Market?

Commercialized Technology?

Effective Program Model (Incentive, Rebate, Upstream, Downstream, Education, Direct Install)?



Passive Cooling Strategies for IT Equipment

Virtualization 2.0 – Server Management

Solid State Data Storage

Cooling Storage Systems

Virtualization 2.5 – IT Workload Management

Heat Recovery

Modular Airflow Isolation

Virtualization 3.0 – Holistic Data Center

Optical Data Storage

Change in Power Delivery Voltage

On-Site Generation

Liquid Cooling Strategies

Performance (data center only)

- ▶ About \$7 million in incentives
- ▶ 7 MW plus of load reduction (5000+ homes)

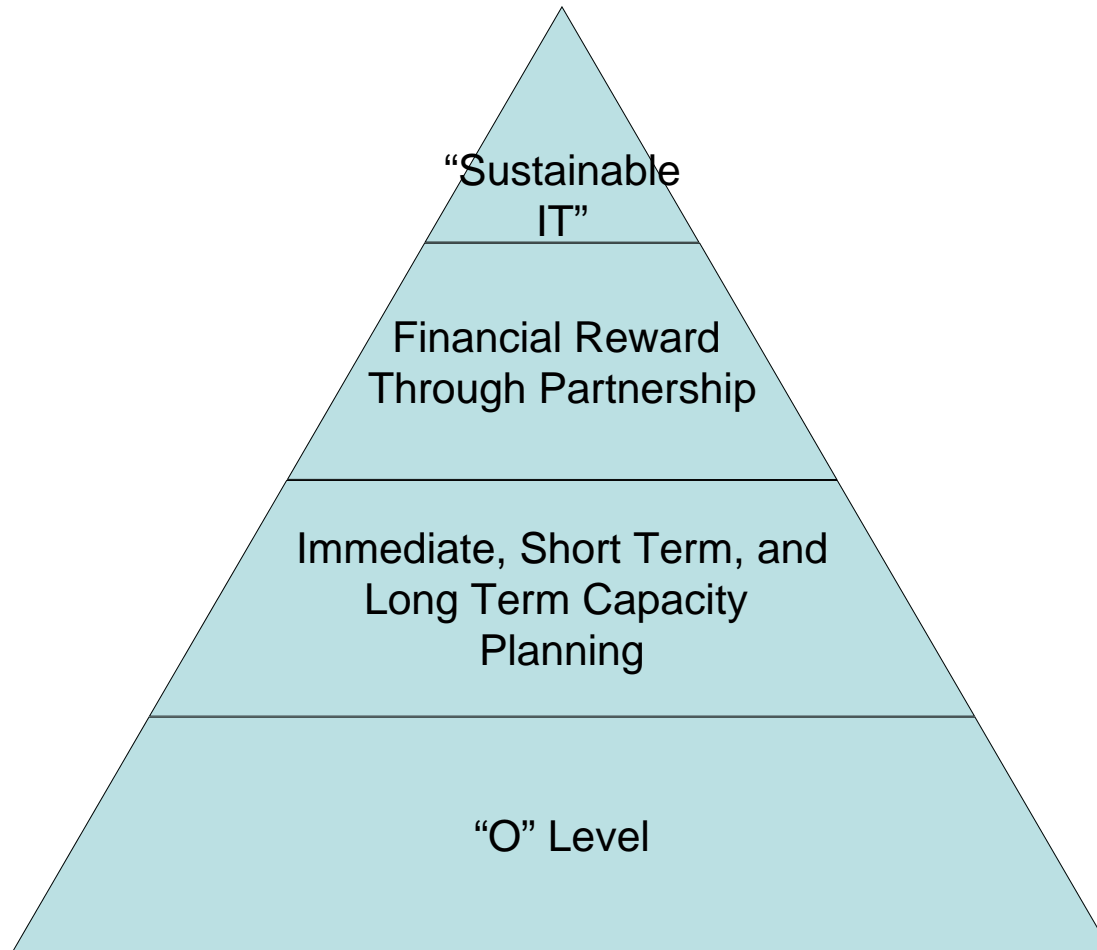
2009–11

- ▶ Reserved \$50 million in data center program funding

Aspiration: 20 MW plus annual load reduction



Bramfitt's "Hierarchy of IT Energy Efficiency Motivation"





Mission Statement: The Utility IT EE Coalition is dedicated to promoting the adoption of energy efficiency programs and services directed towards data centers and information technology infrastructure by utilities across the United States & Canada. Coalition members share program and service designs and technical documents, and industry market intelligence, using a collaborative web site and through regular face-to-face meetings.

- ▶ Demand Response
- ▶ Permanent Load Shifting
- ▶ Onsite Generation
- ▶ Large Load Siting Guidance
- ▶ Pass-Through Power Rates
- ▶ Purchase of Backup Generator Test Power
- ▶ “Smart Grid”

- ▶ Utility industry leadership in data center and IT infrastructure engagement
- ▶ Ongoing partnership with high tech industry
- ▶ We need your support, endorsement, encouragement

Visit www.pge.com/hightech

Contact me with feedback and suggestions:



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