



Tools & Solutions to Address Climate Change Meeting with Denver Business Leaders

August 30, 2007





PG&E's Climate Change Commitment

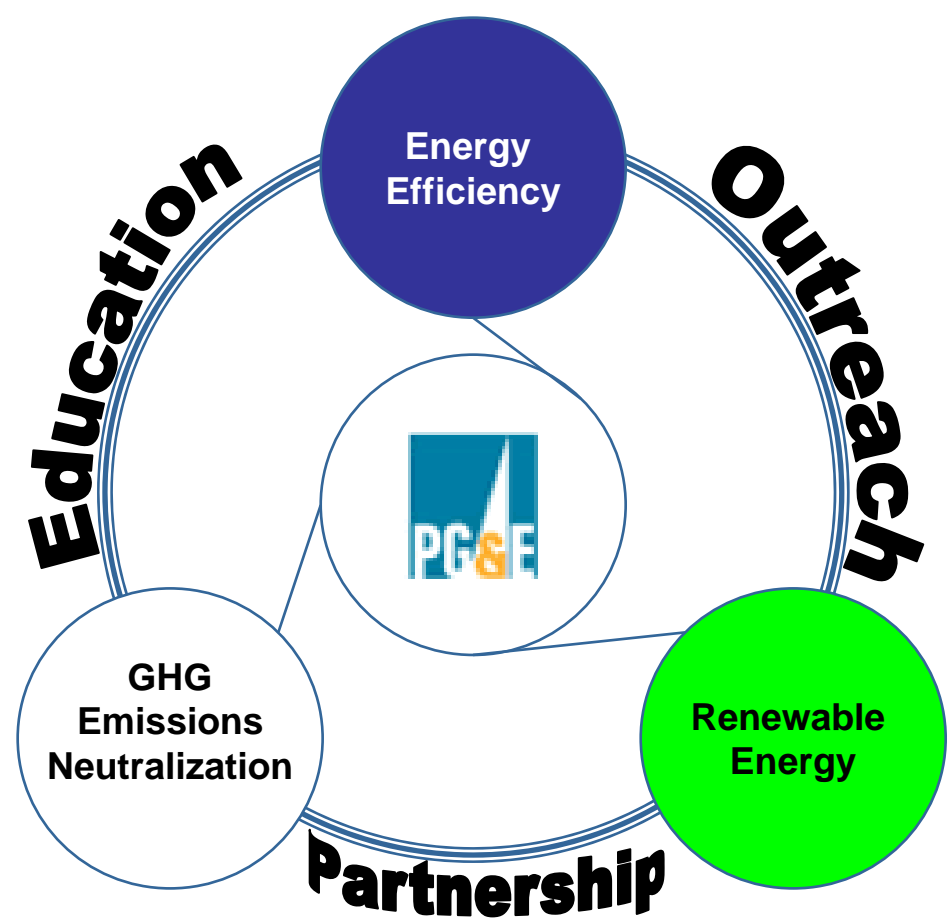
“PG&E is committed to **leading by example** when it comes to climate change. That means more than just minimizing the greenhouse gas emissions from our operations. It also means **maximizing the opportunity we have to lead efforts to establish responsible policies and programs to address global climate change.**”

- Climate Change Commitment
Adopted by PG&E Corporation Board of Directors
May 2006





PG&E's Approach: Integrated Products and Solutions





Putting Energy Efficiency First

“Energy efficiency is California’s highest-priority resource for meeting its energy needs in a clean, reliable, and low-cost manner.”

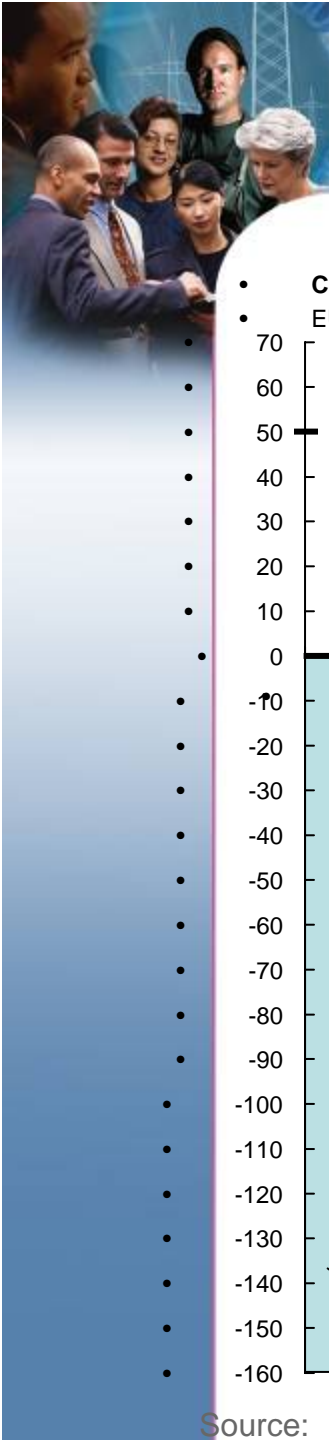
California Public Utilities Commission’s 2006 publication,
Energy Efficiency: California’s Highest-Priority Resource

“Energy efficiency is the lowest-cost way to meet customers’ energy needs.”

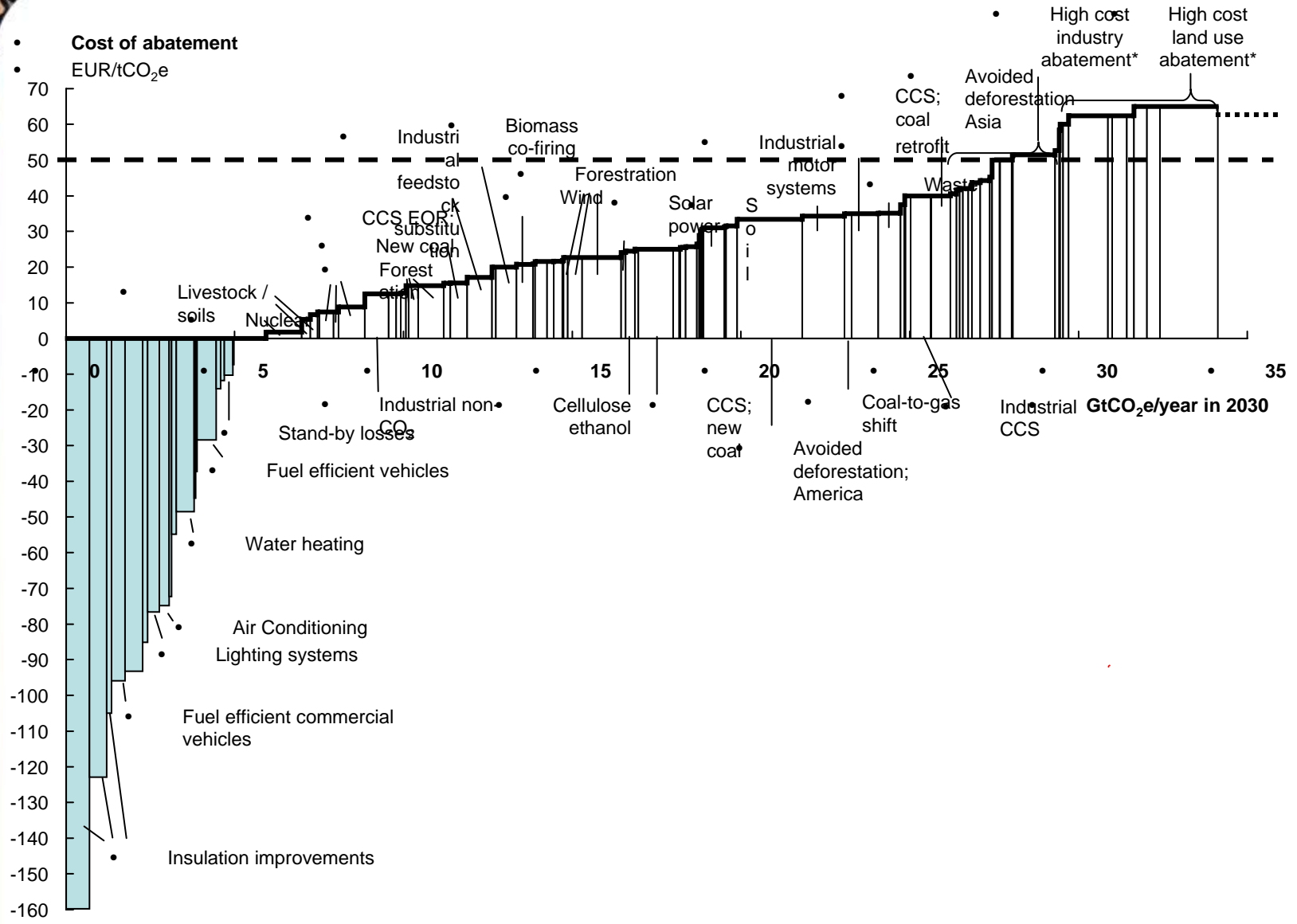
PG&E’s *Global Climate Change* report

Why Energy Efficiency?

- Energy efficiency is the lowest cost, most effective way to avoid greenhouse gas emissions and combat global climate change
- California's Energy Action Plan established a preferred "loading order" for resource procurement which prioritizes energy efficiency
 1. Energy Efficiency
 2. Demand Response
 3. Renewable Resources
 4. Distributed Generation
 5. Conventional Sources



Global cost curve of greenhouse gas abatement opportunities for 2030



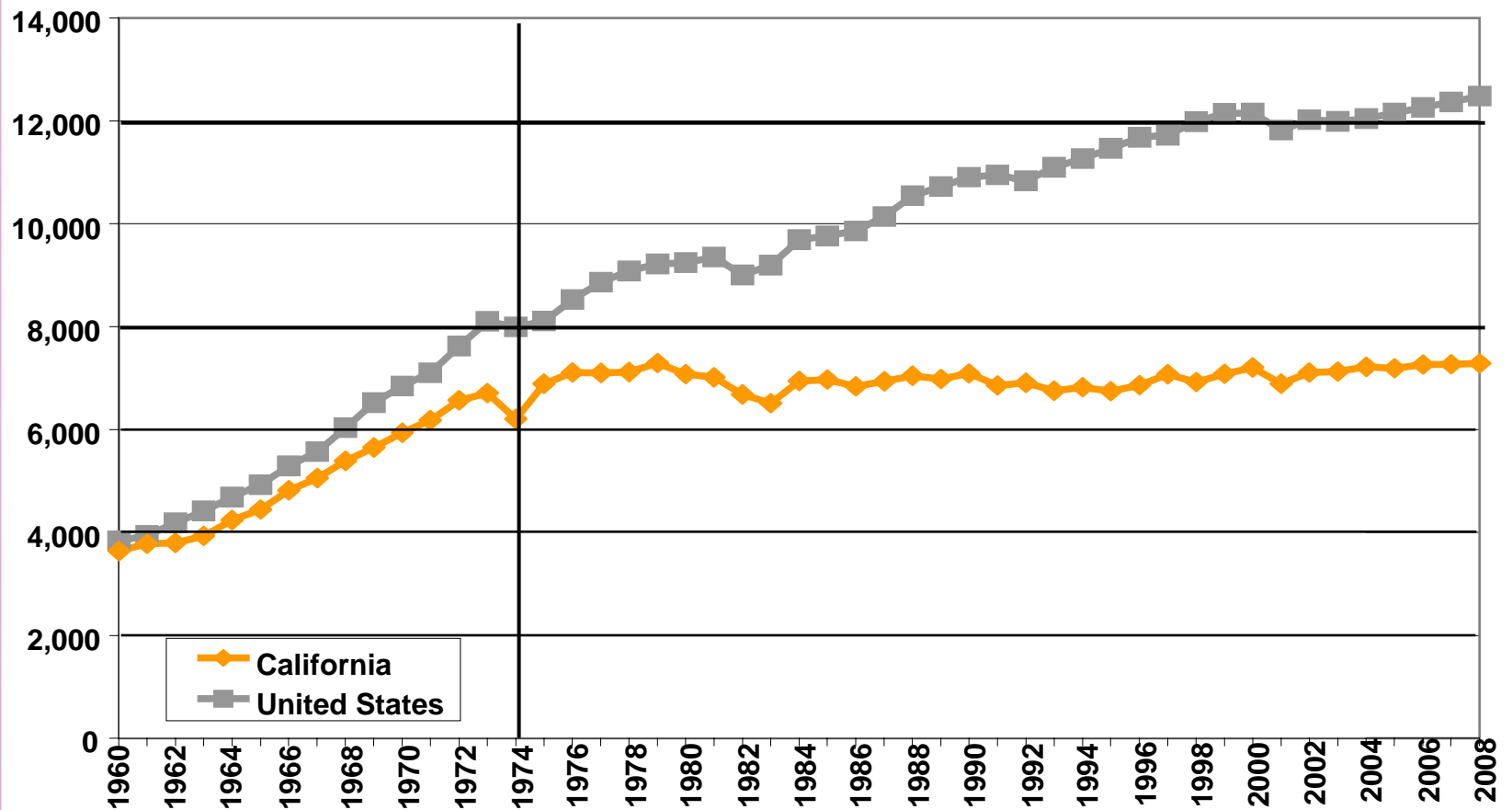
Source: McKinsey analysis for Vattenfall

Eras of Energy Efficiency

- **1970s: Conservation**
 - Began information and audits with a focus on reducing usage
- **1980s: Demand-Side Management**
 - Expanded to include demand response (load management) and continued with conservation
- **1990s: Resource Acquisition**
 - Focus on installation of more efficient equipment with extensive post-installation savings measurement
- **1998 – 2000: Energy Efficiency Restructuring**
 - CPUC shifts policy to non-utility administration and “transforming markets”
- **2001: Energy Crisis**
 - Resurgence of resource focus; expansion of programs

Energy Efficiency: The Fastest, Cheapest Solution

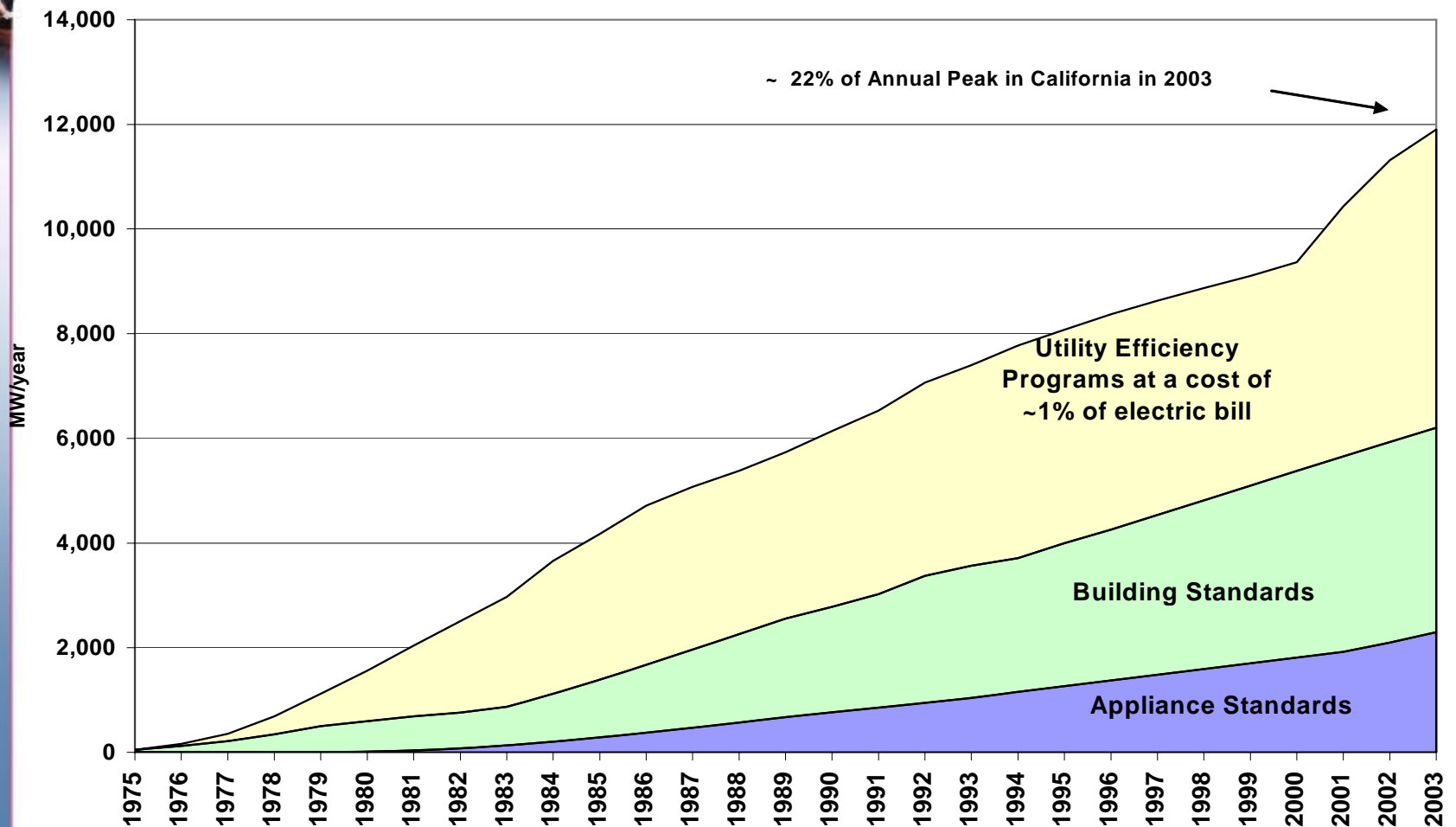
- Energy efficiency programs have helped keep per capita electricity consumption in California flat over the past 30 years
- PG&E's programs have avoided the release of over 125 million tons of CO₂ into the atmosphere over the same period



Note: 2005 – 2008 are forecast data.

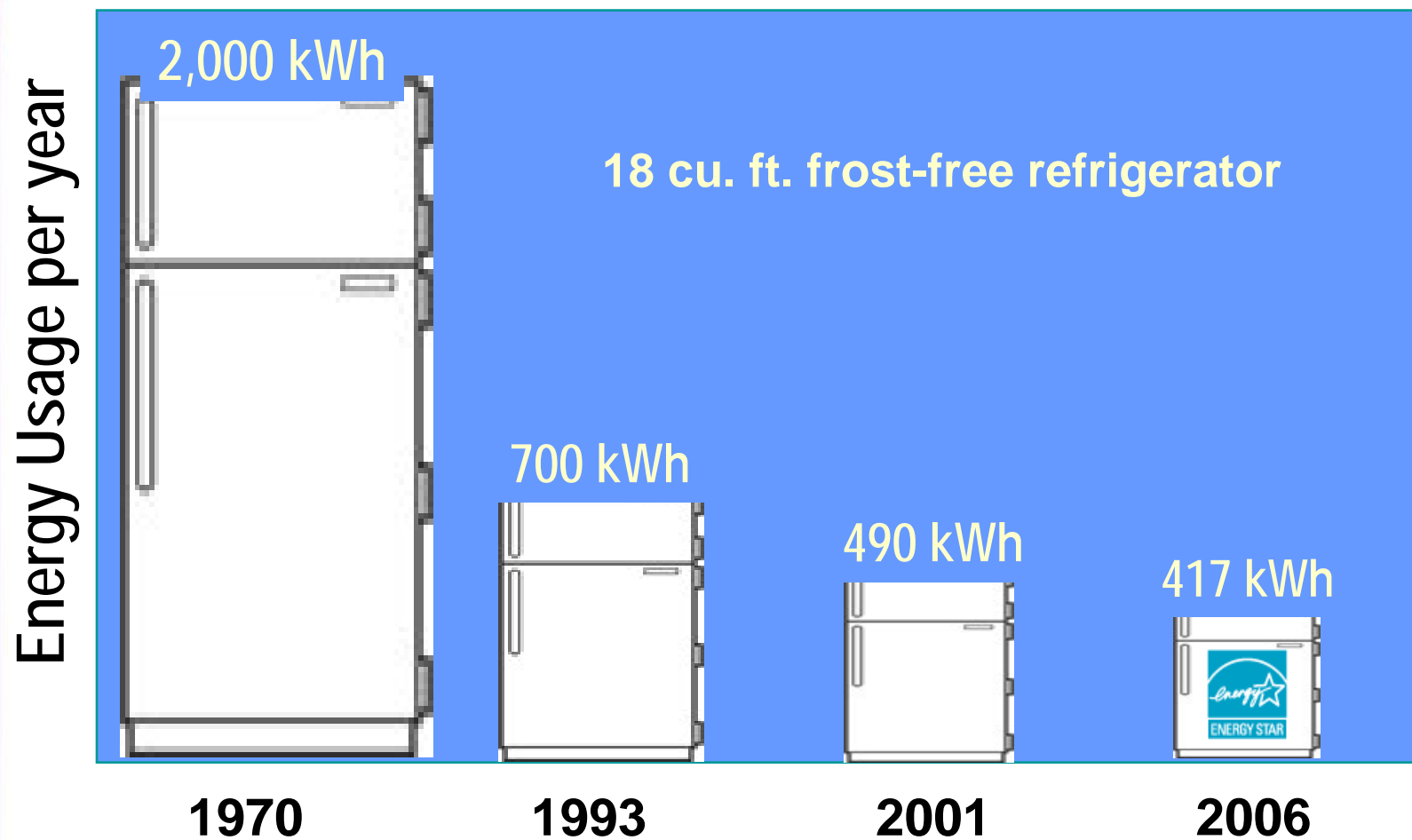
Graph courtesy of Art Rosenfeld, California Energy Commission

Annual Peak Savings From Efficiency Programs and Standards



Graph courtesy of Art Rosenfeld,
California Energy Commission

Appliance Standards – A Big Impact





The Numbers Talk...

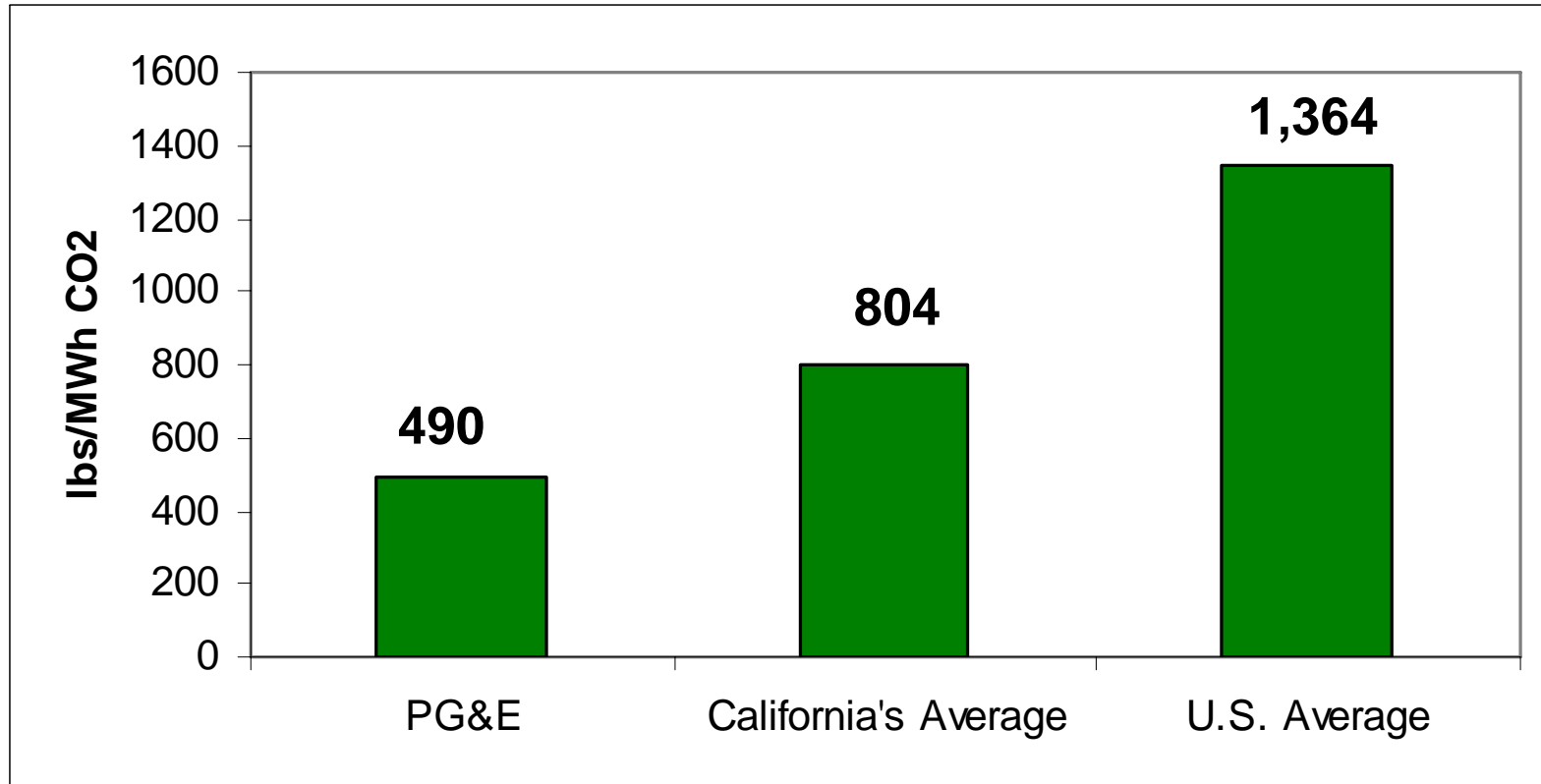
Since 1976 PG&E's energy efficiency programs have:

- Saved more than 118 million megawatt-hours and 10.7 billion therms from installed measures (cumulative lifecycle savings)
- Saved enough annual electricity to power over 18 million homes and enough annual natural gas to heat 15 million homes
- Helped California avoid building 24 large power plants
- Kept over 125 million tons of CO₂ out of the atmosphere, based on combined electric and natural gas savings

Take Aways

- Educate your members
 - Partner with utility
 - Bring in vendors to help
- Measure what you are using
- Put in goals for the organization
- Seek easy wins
 - Phantom loads
 - Energy hogs that can be replaced
 - Unnecessary lighting
- Seek technology solutions/opportunities

Benchmarking GHG Emissions for Delivered Electricity

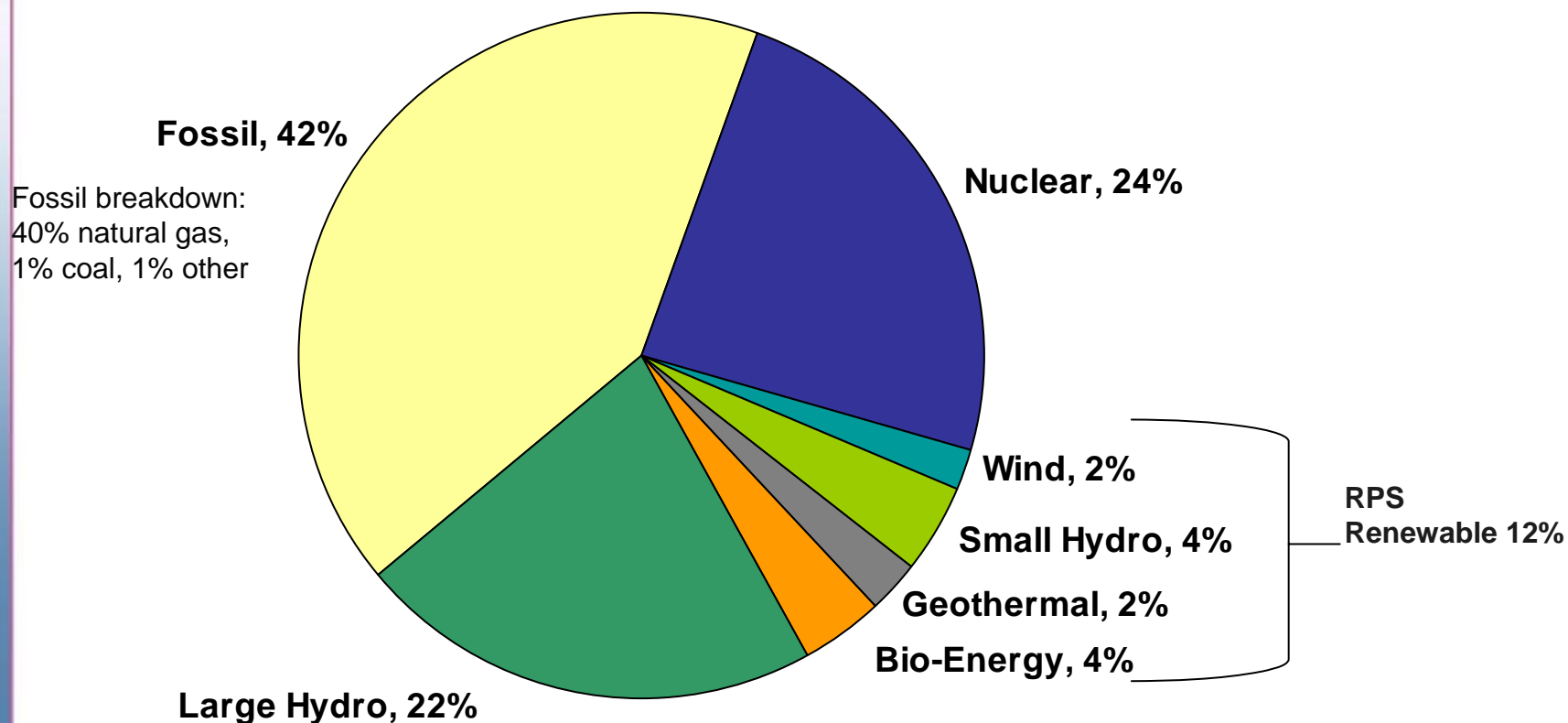


Note: All figures for emissions from electric power generation.

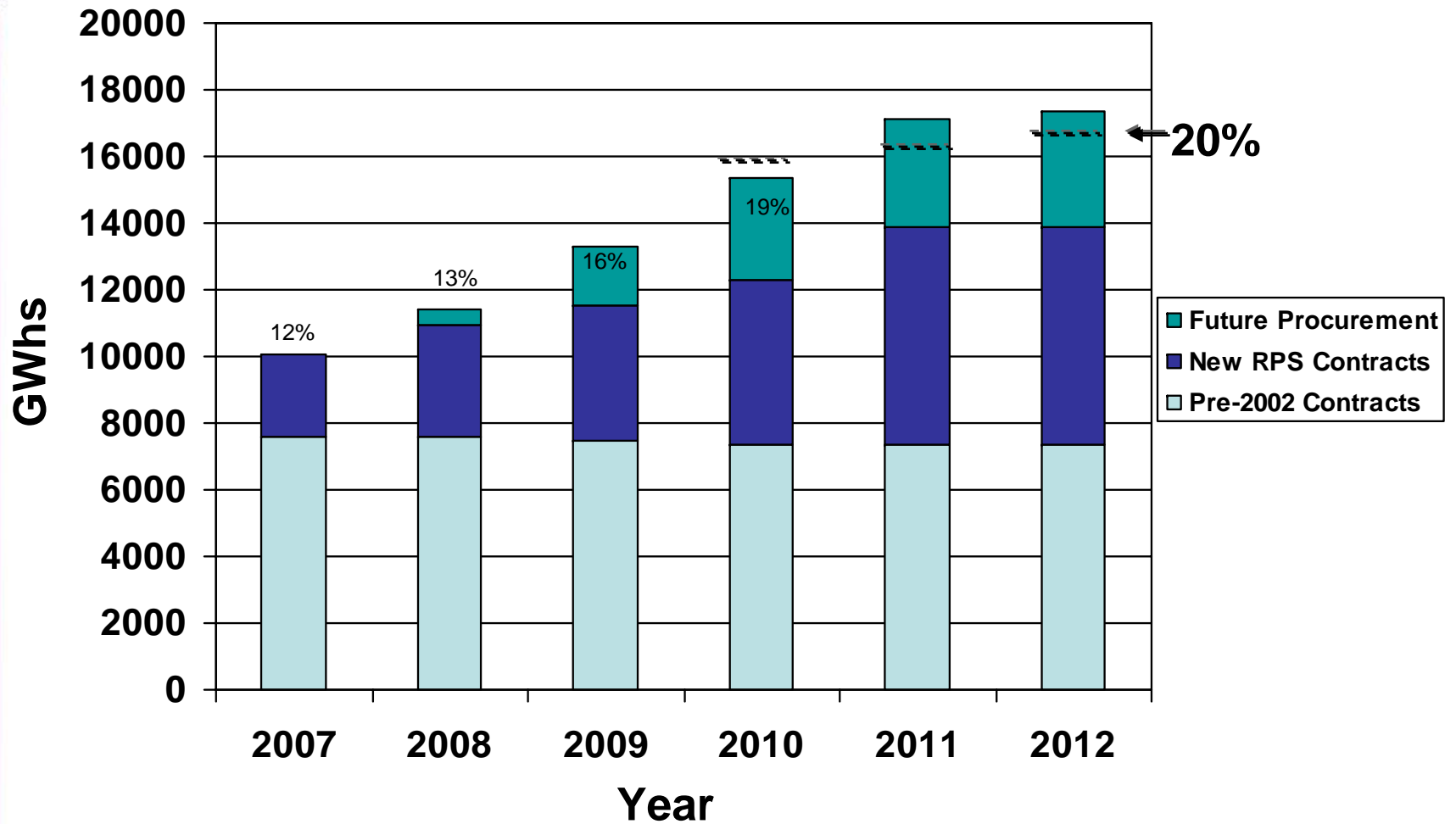
PG&E's GHG emissions inventory is registered with California Climate Action Registry.

PG&E's Diversified Resource Portfolio

2006 Electric Energy Deliveries by Technology



PG&E Expects to Meet the 20% Goal Under Flexible Compliance Rules



- 2008 to 2012 estimates are based on forecasted construction schedules and additional contracted resources
- Assumes that all contracts perform

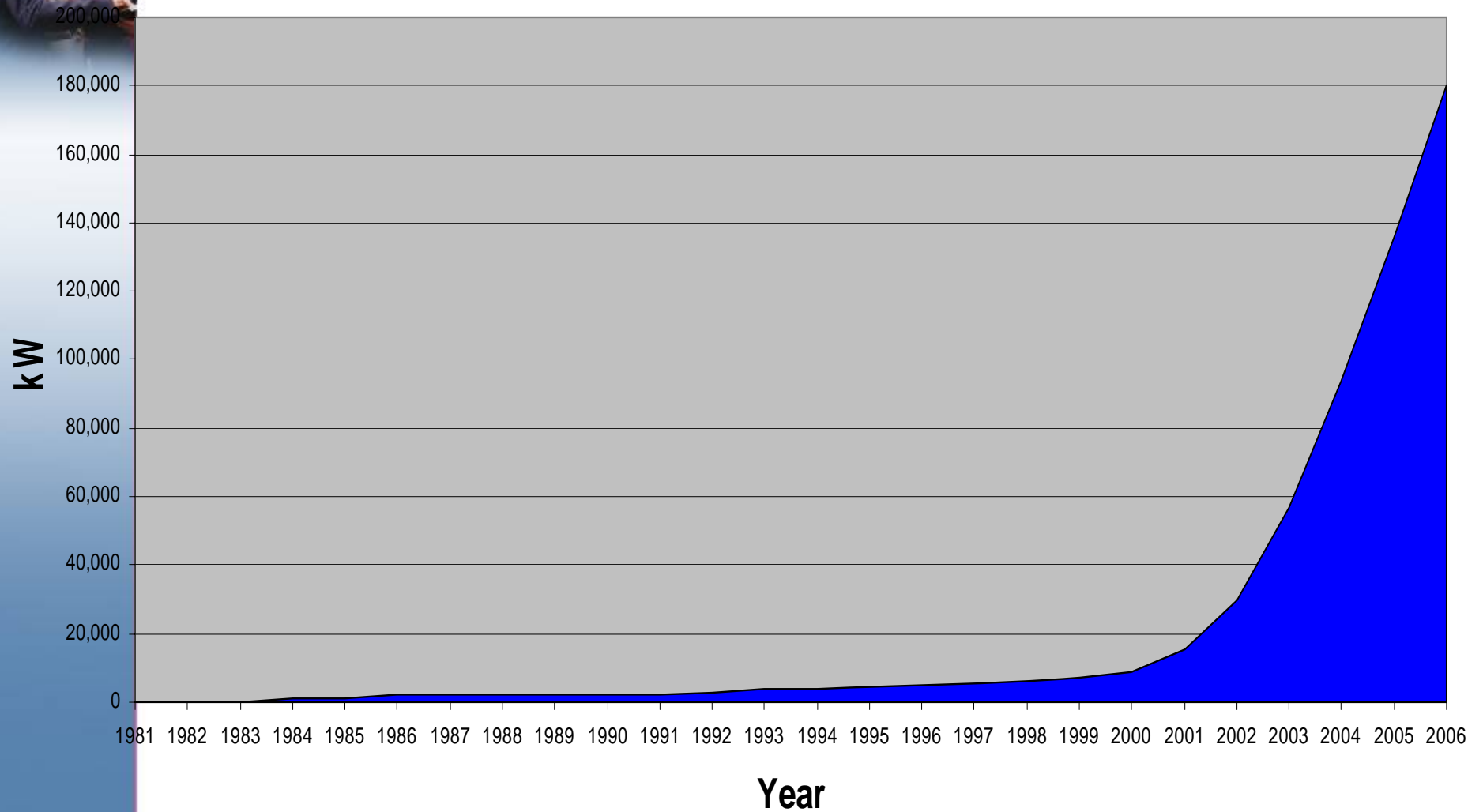


California Solar Initiative (CSI)

- Long-term solar incentive program
 - Statewide goal: 3,000 MW of new solar generation by 2017
- Provides \$2+ billion in incentives over the next decade (~ \$1 billion in PG&E territory)
- Emphasis on performance-based incentives
- Nonresidential and Residential Retrofit projects are administered by PG&E



Grid-Connected PV Capacity Installed in California Cumulative



Source: California Energy Commission (CEC)

A group of diverse people, including men and women of various ethnicities, are shown in a professional setting, possibly a meeting or a collaborative work environment. They are looking towards the right side of the frame.

Self-Generation Incentive Program (SGIP)

- Incentives for clean and renewable on-site generation
 - Wind turbines
 - Renewable fuel cells
 - Renewable fuel internal combustion engines and large gas turbines
 - Certain non-renewable technologies (e.g., fuel cells, waste gas, etc.)

ClimateSmart – “Climate Neutral” Energy



Make your greenhouse gas emissions neutral with ClimateSmart



5.3 tons CO₂ per year

5.3 tons CO₂ per year
(typical home)



100% of
ClimateSmart
payment

Less than
\$5 per month



Carbon dioxide (CO₂) emissions for a typical residential customer are
68% from natural gas and 32% from electricity

Take Aways

- Support local job development with solar installers
 - Partner with local community colleges for job training
 - Partner with installers to demystify solar
- Provide examples as business leaders
 - Drive a Prius already? Why not add solar thermal to your home roof for hot water?
- Environment of business development in leading areas
 - Thin film solar for BIPV
 - Biodigester technology for use in cattle operations
 - Business incubators



Sustainable Communities Vision

A sustainable community protects and enhances the overall health, natural environment, and quality of life of its members and maintains the fundamental balance between its economy, equity and ecology.

PG&E envisions sustainable communities that embody principles to support a high quality of life within the carrying capacity of one planet and strive to achieve the following One Planet Living objectives:

- **Zero Carbon:** Reducing carbon dioxide emissions by optimizing building and infrastructure energy demand and supplying from zero or low carbon and renewable resources.
- **Zero Waste:** Achieving a substantial reduction of waste flows to landfill by reducing waste production and valuing all materials as potential resources, through reuse, reprocessing or generating energy from waste.
- **Sustainable Water:** Reducing energy used in water supply and waste water management; reducing flooding risks and conserving water resources.
- **Sustainable Transportation:** Reducing the need to travel, providing alternatives to private car use, and providing more sustainable private car options.
- **Local and Sustainable Materials:** Maximizing the use of local, reclaimed, recycled and non-toxic materials that have low-embodied energy.

Sustainable Communities Program

Existing PG&E Programs

Energy Efficiency & Demand Response

Incentives, education for demand side management

California Solar Initiative (CSI)

Incentives for PV solar installations and non-PV thermal solar installations (AL pending)

Self Generation Incentive Program (SGIP)

Incentives for distributed generation

ClimateSmart

Opt-in to neutralize carbon emissions

Clean Air Vehicle Programs

Reduce greenhouse gas and toxic exhaust emissions in transportation sector; assess low emissions vehicles

Proposed Programs

Sustainable Communities Education

- Green Building 101, event sponsorships, job training
- PG&E Sustainability Center

Sustainable Communities Tech Assistance

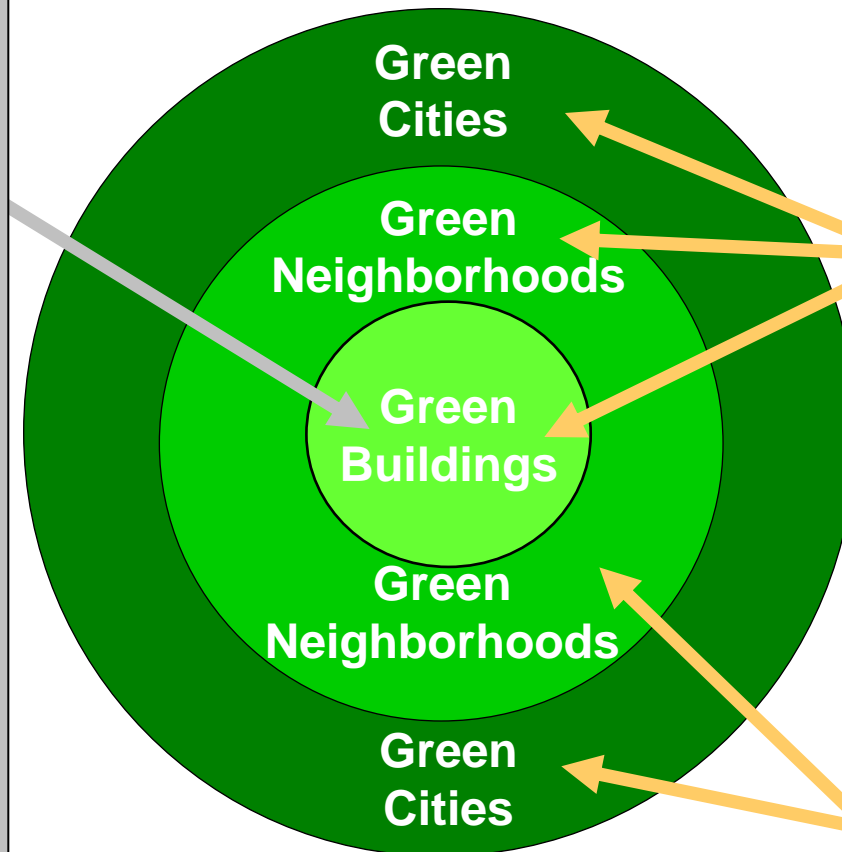
- Green design and consulting services
- Green city general plans, carbon reduction strategies

Sustainable Communities Incentives

- LEED certification, energy innovation, shade trees
- Green city planning tools

Sustainable Communities Pilot Projects

Investments in neighborhood energy centers, district heating & cooling, trigeneration, vehicle to grid



Incentives

- **Pay LEED registration and certification fees**
 - Single buildings, multiple buildings, new developments, master planned communities
- **Underwrite Sustainability Planning Tools**
 - Local government, regional planners, educational institutions
- **Incentives for innovation**
(e.g., Zero Energy buildings, Carbon Neutral buildings, Reduced Urban Heat Island Effect)
 - Builders, developers

Types of Technical Assistance

- **Buildings & Communities**
 - Project planning, siting, infrastructure planning, building massing, energy efficiency, waste heat recovery, heat island reduction, comprehensive carbon reduction plans, water efficiency, etc.
- **Local Governments & Institutions**
 - Goal setting, measurement methodologies
 - General Plans, sustainability plans / policies, climate change action plans
 - Summits on green building
 - Recommendations to encourage LEED building

Education Opportunities

- **Provide SC Education and Training**
 - Green Building and LEED 101
 - Technical design and sustainability topics
 - Incorporating job training into SC projects
- **Event Sponsorships**
- **Community Education Centers**
- **PG&E Center(s) for Sustainability**

Sustainable Community Examples



Sonoma Mountain Village

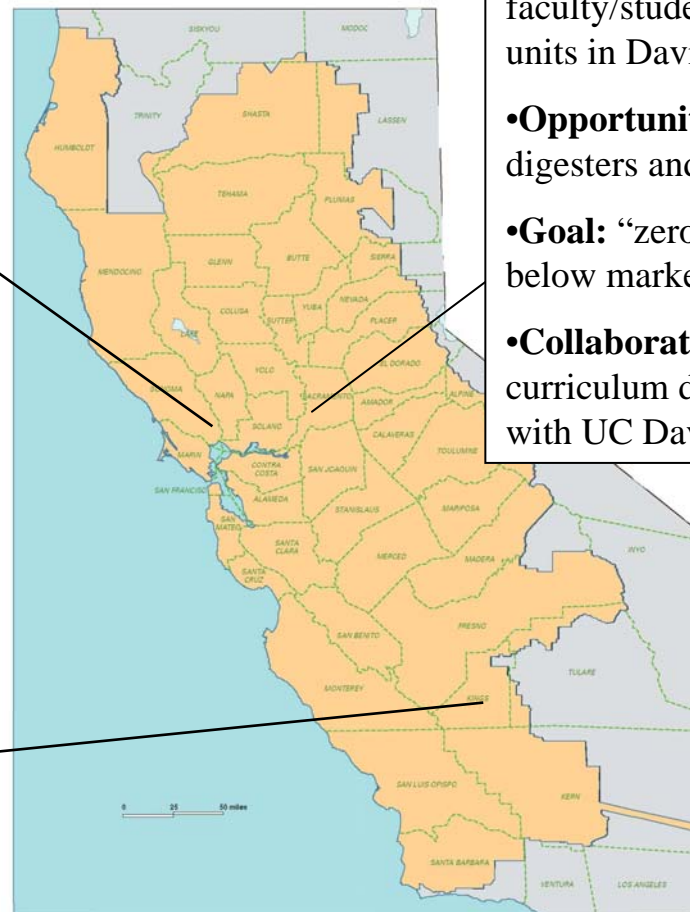
- 200 acres in Rohnert Park, mixed use - 1900 res, 500K ft² commercial
- **Opportunity:** PHEV/V2G, super-efficient buildings, onsite wastewater treatment
- **Goal:** Zero Carbon
- **Collaboration:** Sonoma State, One Planet Living

Quay Valley

- 50,000 dwelling units in Kings County
- **Opportunity:** integrate smart homes and smart grid, community scale DG, district heating and cooling, combined heat and power
- **Goal:** 100% solar, “zero energy bill”
- **Collaboration:** Fresno State

West Village

- New mixed use - 2000 faculty/student housing units in Davis
- **Opportunity:** biomass digesters and transport
- **Goal:** “zero energy bill”, below market rate housing
- **Collaboration:** curriculum development with UC Davis





Pilot Project Example: Combined Heat & Power/Fuel Cell using Biodigester

- Feedstock
 - Inedible used organic waste and restaurant grease
 - Delivered from neighborhoods by waste haulers
- Biodigester
 - Microorganism eat grease creating methane
 - Methane used to power microturbine for power
 - Excess heat used in cogeneration heats buildings and biodigester
- Deliverable and costs
 - 250 kW microturbine to 900 kW fuel cell
 - Measurable CO₂ reduction emissions
 - Capital costs \$5M to \$15M before SGIP



Pilot Project Example: District Heating and Cooling

- Feedstock:
 - Natural gas
 - Possibly biomass and waste to energy
- Central Heating and Cooling Station
 - Steam and chilled water produced and piped through underground network to buildings for heating and A/C
 - Economies of scale in distribution of heat and cooling
 - Good for planned communities or central locations (campuses)
- Deliverable and costs
 - Address community heating and cooling needs throughout the year
 - Adoption of biomass and other non-carbon based fuel is an option
 - Capital costs \$2M (neighborhood) to \$40M (community), depending on the size of the facility

Take Aways

- Encourage city and counties to provide “fast track” permitting for those develops pursuing LEED
- Work with developers to maximize homes for solar
- Look at means to reduce USE
 - Water use/waste water
 - Solid waste
- Approach community in its entirety, just not individual pieces
- Look to Old Snowmass for advice

Plug-In Hybrid Vehicles / Vehicle-to-Grid

- Larger, more powerful battery can be plugged into standard electric outlet
- Gets 100 miles per gallon of gasoline during a typical commute
- Fully charged can go 20-30 miles electric-only
- Not yet commercially available



Vehicle-to-Grid Concept:
Enables cleaner, cheaper off-peak energy storage for uploading during peak demand and emergency power outages

PG&E and Customer Natural Gas Fleets

- Last year, the 36 compressed natural gas (CNG) fueling stations PG&E owns and operates supplied natural gas to more than 200 commercial and private fleets
- PG&E also purchased 275 new CNG vehicles, giving us a fleet of more than 1,180 vehicles that run on natural gas, the largest utility fleet of its kind in the nation
- As a result of these efforts, as well as the vehicle natural gas used by our customers, PG&E avoided the use of more than 15.7 million gallons of petroleum and the emission of approximately 670 tons of NOX, 43 tons of particulate matter and 28,630 tons of CO₂



Take Aways

- Fleet management massive opportunity
 - CNG
 - Electric cars with limited range
 - Biofuels
 - Hydrogen (in the future)
- Plug-in Hybrids/second cars
 - One car for local
 - One car for Summit County
 - Infrastructure/back bone for V2G
- Transportation is massive opportunity to make an impact



A Sustainable Community

