

Powering California Forward

CPUC Thought Leaders Series

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California, Outlier or Leader?

Renewables Standard

Greenhouse Gas Cap

Electric Car Mandate

Energy Efficiency

Decoupling

Smart Grid

Solar Rooftops

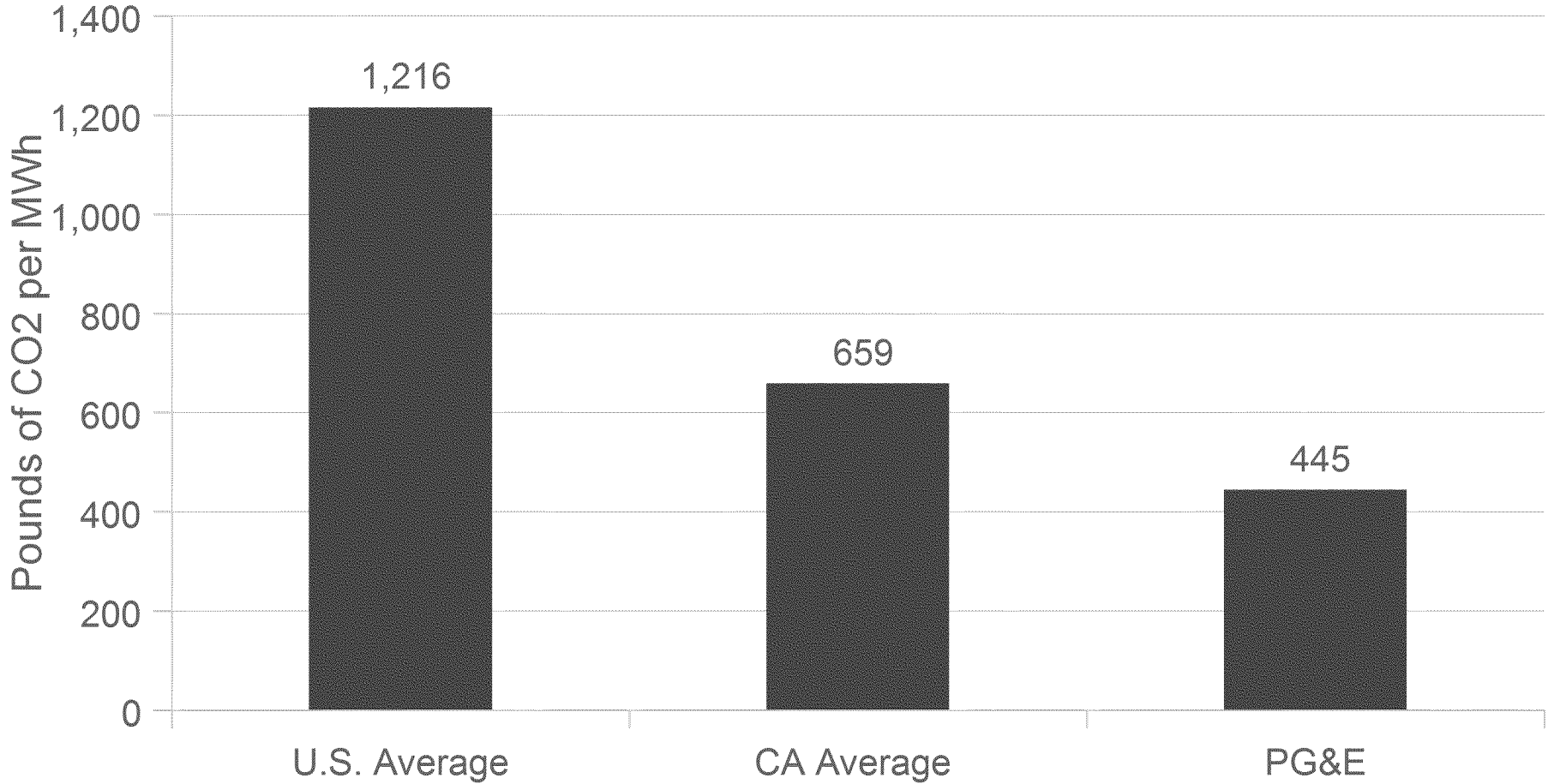
Nuclear

California's Energy Policy: A Path to a Sustainable Future by 2020



PG&E: Delivering Clean Energy

CO₂ Emissions for Delivered Electricity



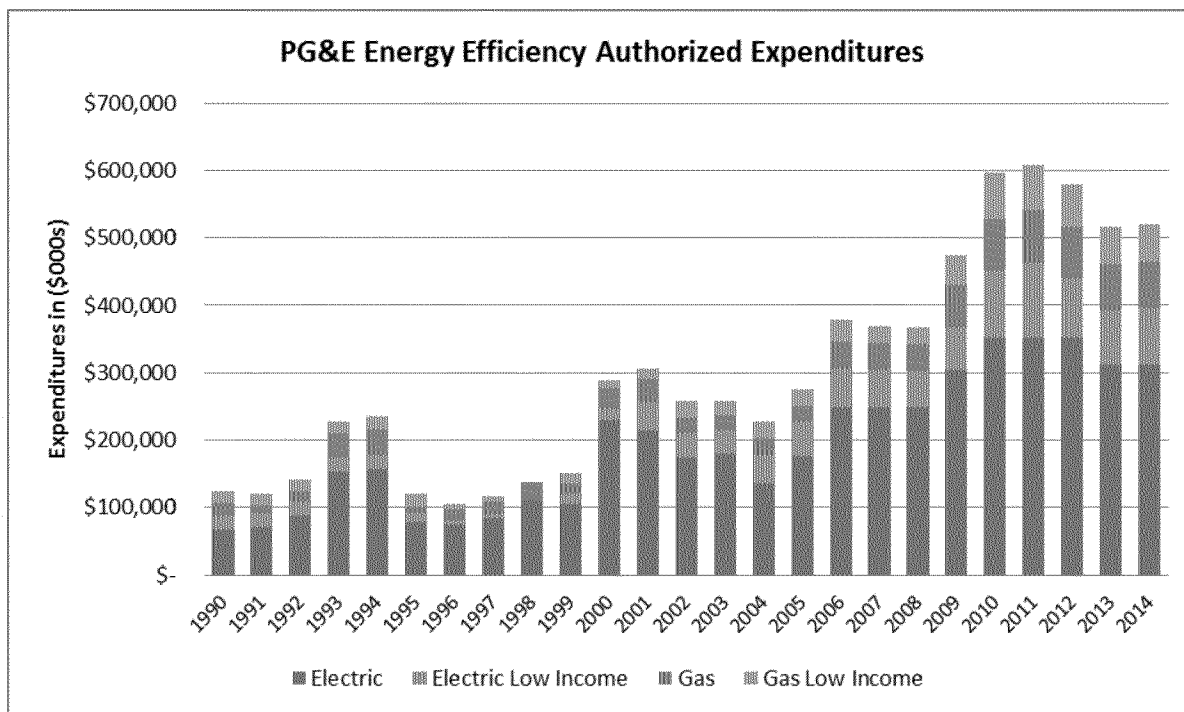
Source: U.S. and CA averages, U.S. Environmental Protection Agency.

Source: The Climate Registry, a third party verification of greenhouse gas emissions data.



Energy Efficiency: Ingrained in the PG&E Culture

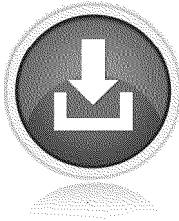
- Legislation enacted in 1974 to “reduce wasteful, inefficient ... consumption of energy.”
- Decoupling of natural gas sales in 1978; electric sales in 1982
- Shareholder incentive adopted in 1993
- Significant growth in funding for energy efficiency programs





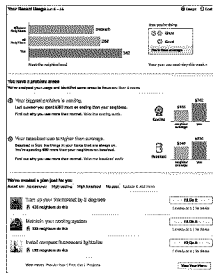
PG&E Smart Grid Investments

Engaged Consumers



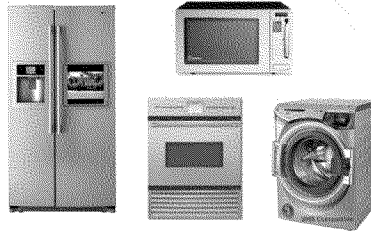
Green Button
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Online Information

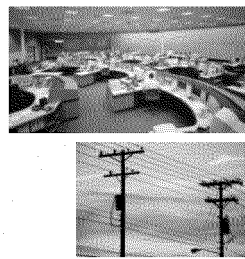


Home Energy Reports

Smart Markets

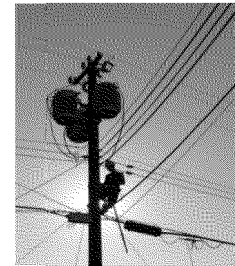


Customer Energy Management

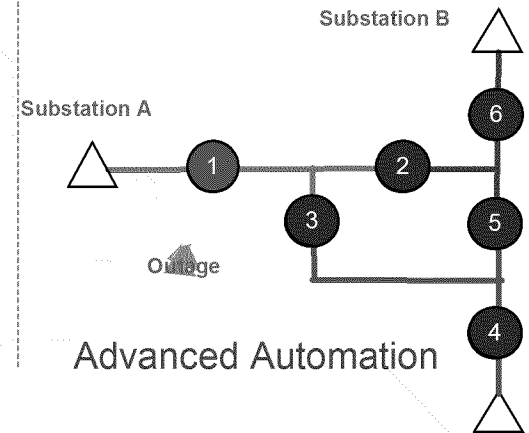


Automated Demand Response

Smart Utility



Outage and Load Management



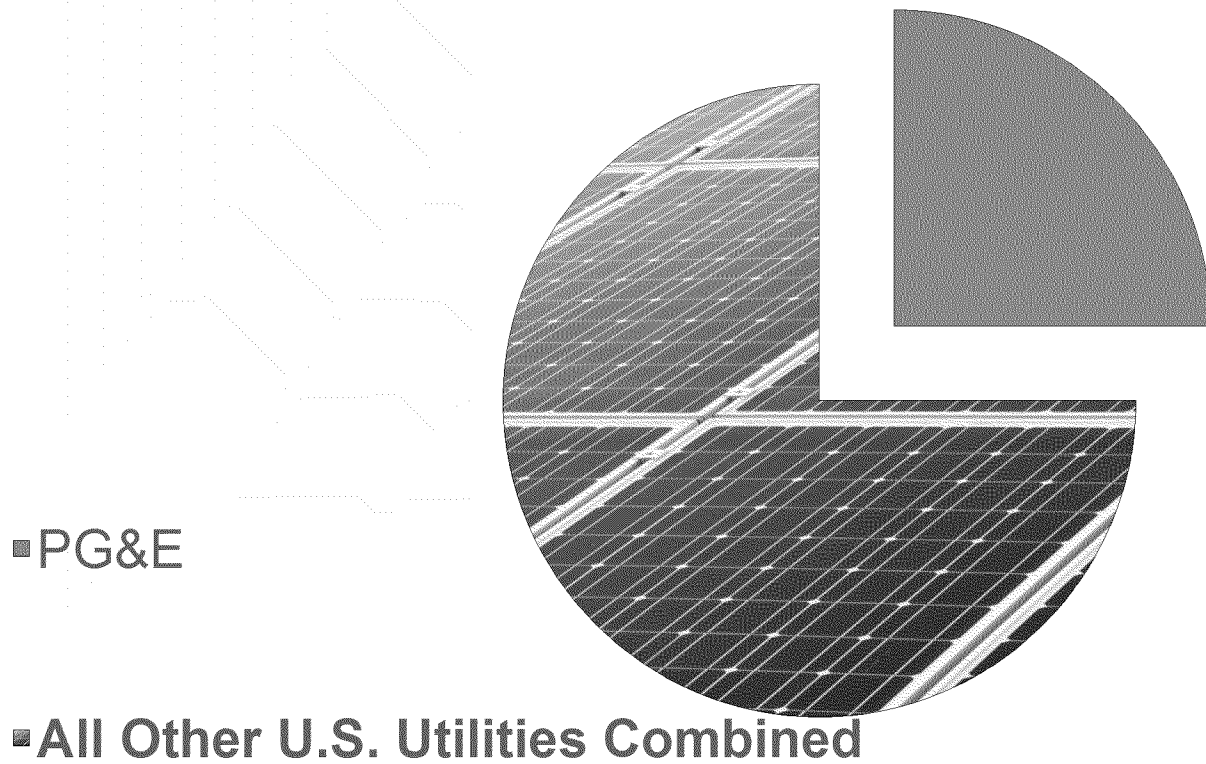
Advanced Automation

PG&E is using Smart Grid technologies to provide customers with benefits today



PG&E is a Leader in Retail Solar PV

One-fourth of customer solar installations in the U.S. are in PG&E's service territory

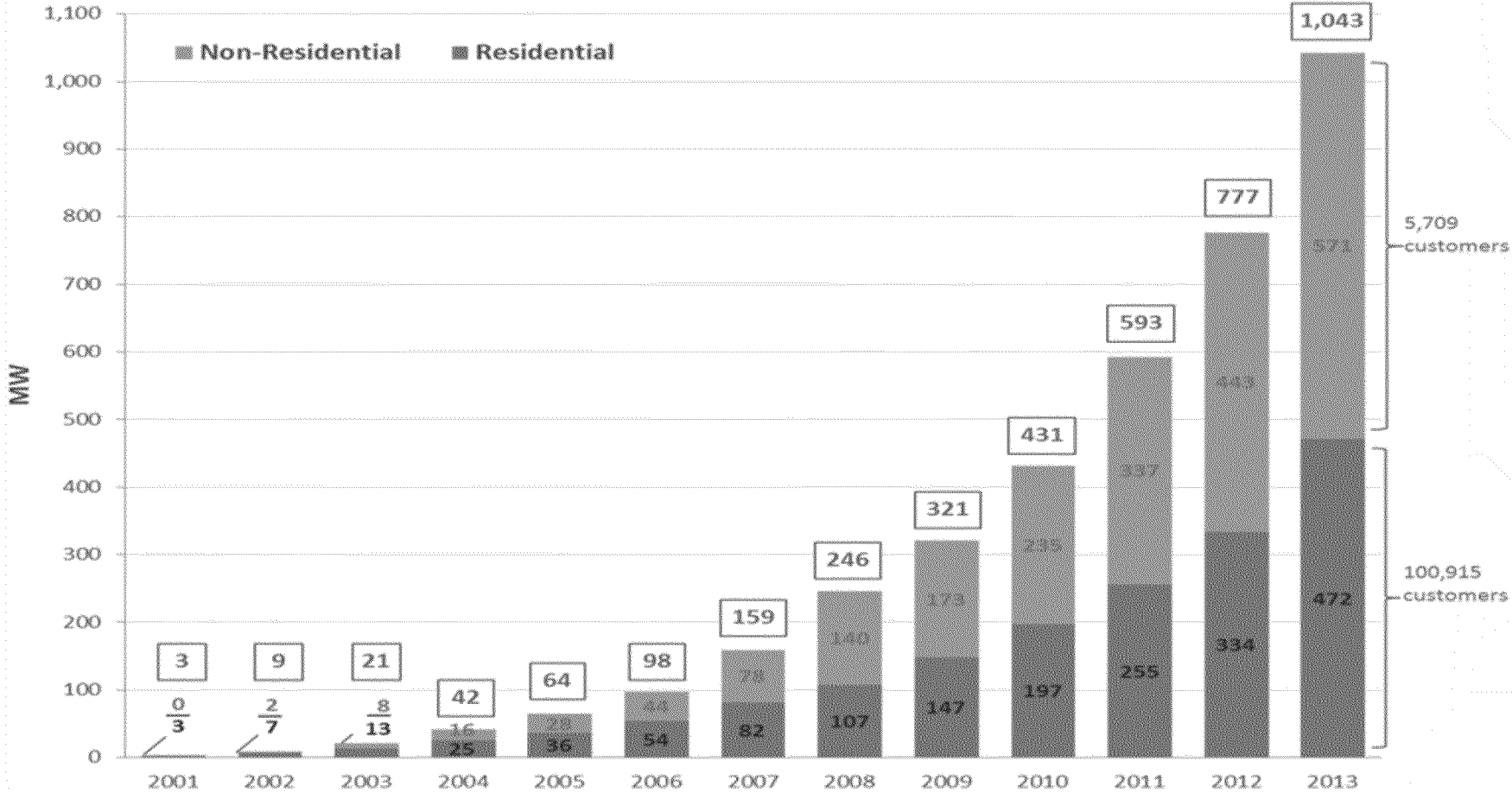


Source: Annual survey by the Solar Electric Power Association for 2012 (2013 results available June 2014).



Customer PV has Grown Significantly

Cumulative Customer-Side PV Capacity*

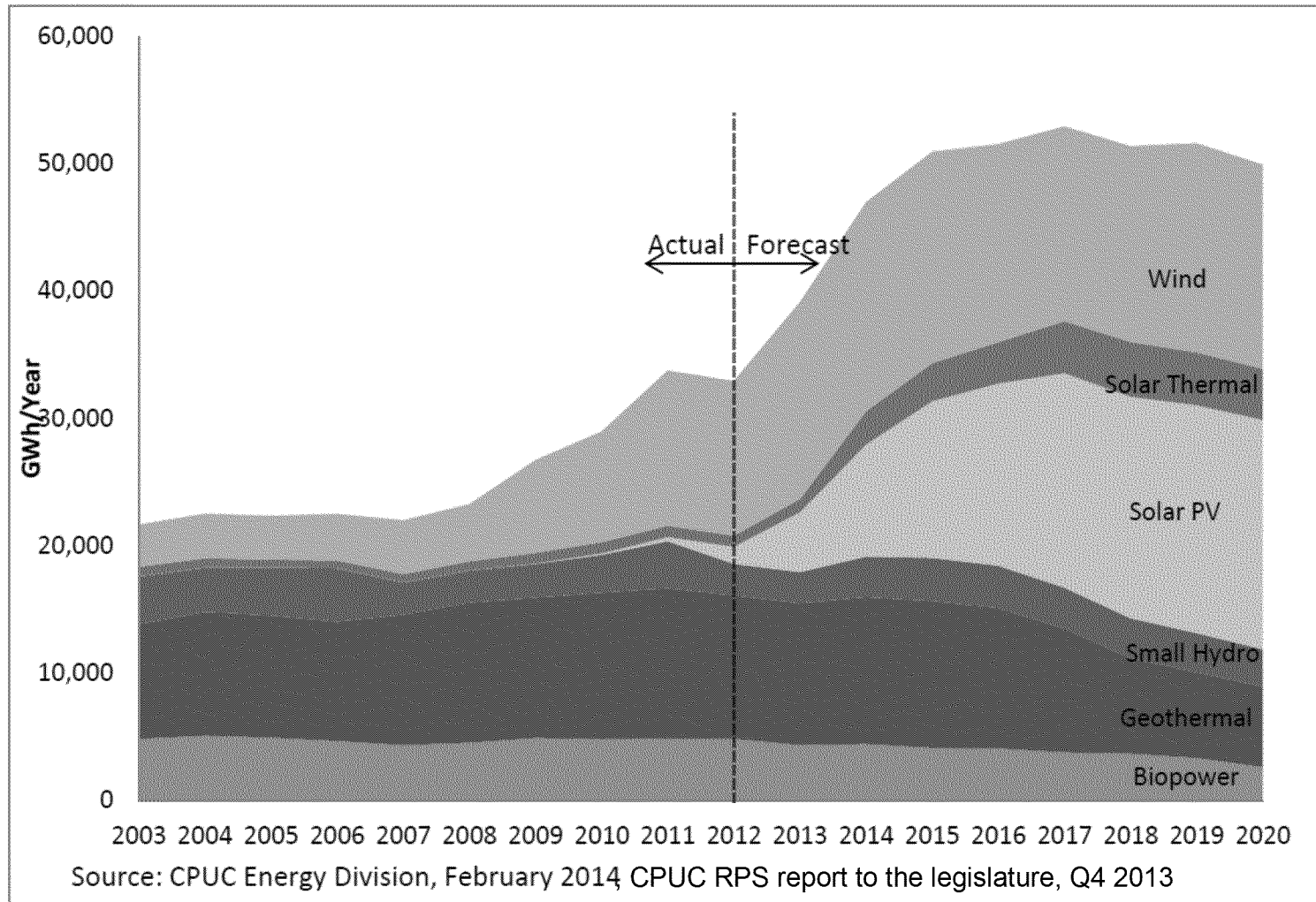


* Capacity is CEC AC and includes all NEM and non-NEM customer-side PV capacity. Some previous versions of this chart include only NEM capacity, so totals were, on average, 5% lower than above.



California Utility Scale Renewables⁸ Increasing Dramatically

Figure 3: Renewable Resource Mix, Actual and Forecasted by Year^{11,12}



11. Figure is not risk-adjusted and forecast does not assume re-contracting of contracts whose terms expire prior to 2020.

12. Data Source: 2003-2010 data from the Provisional 20% RPS Closing Report (1/13/14); 2011-2020 data from the 2012 RPS Compliance Reports (8/1/13).



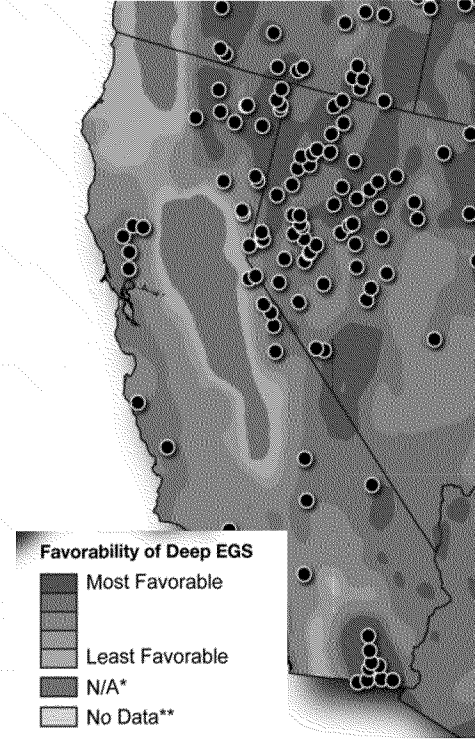
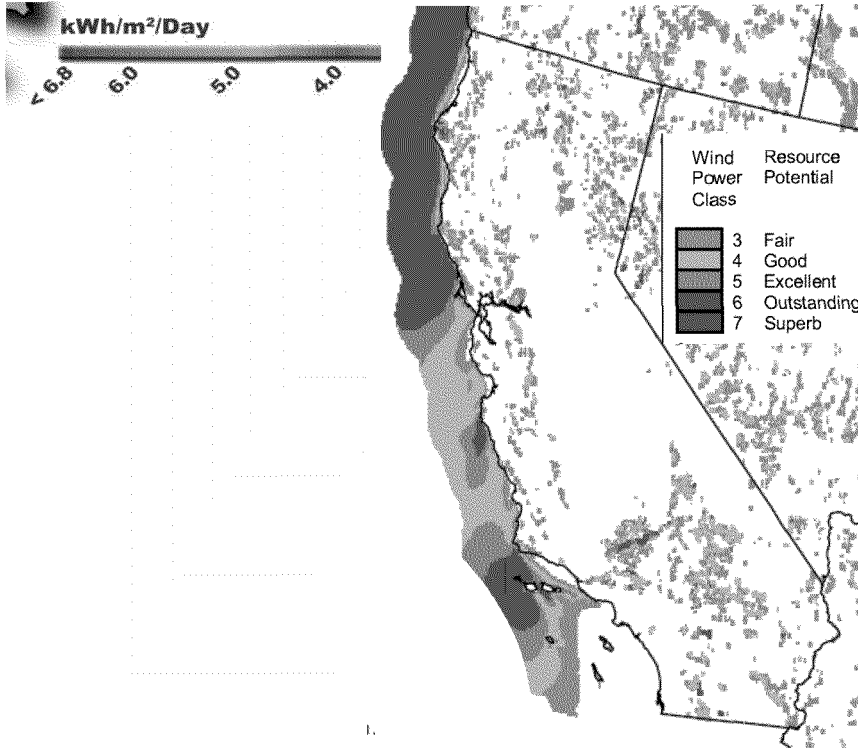
California is Rich in Renewable Resources

Solar

Wind

Biomass

Geothermal



Source:  **NREL**
NATIONAL RENEWABLE ENERGY LABORATORY

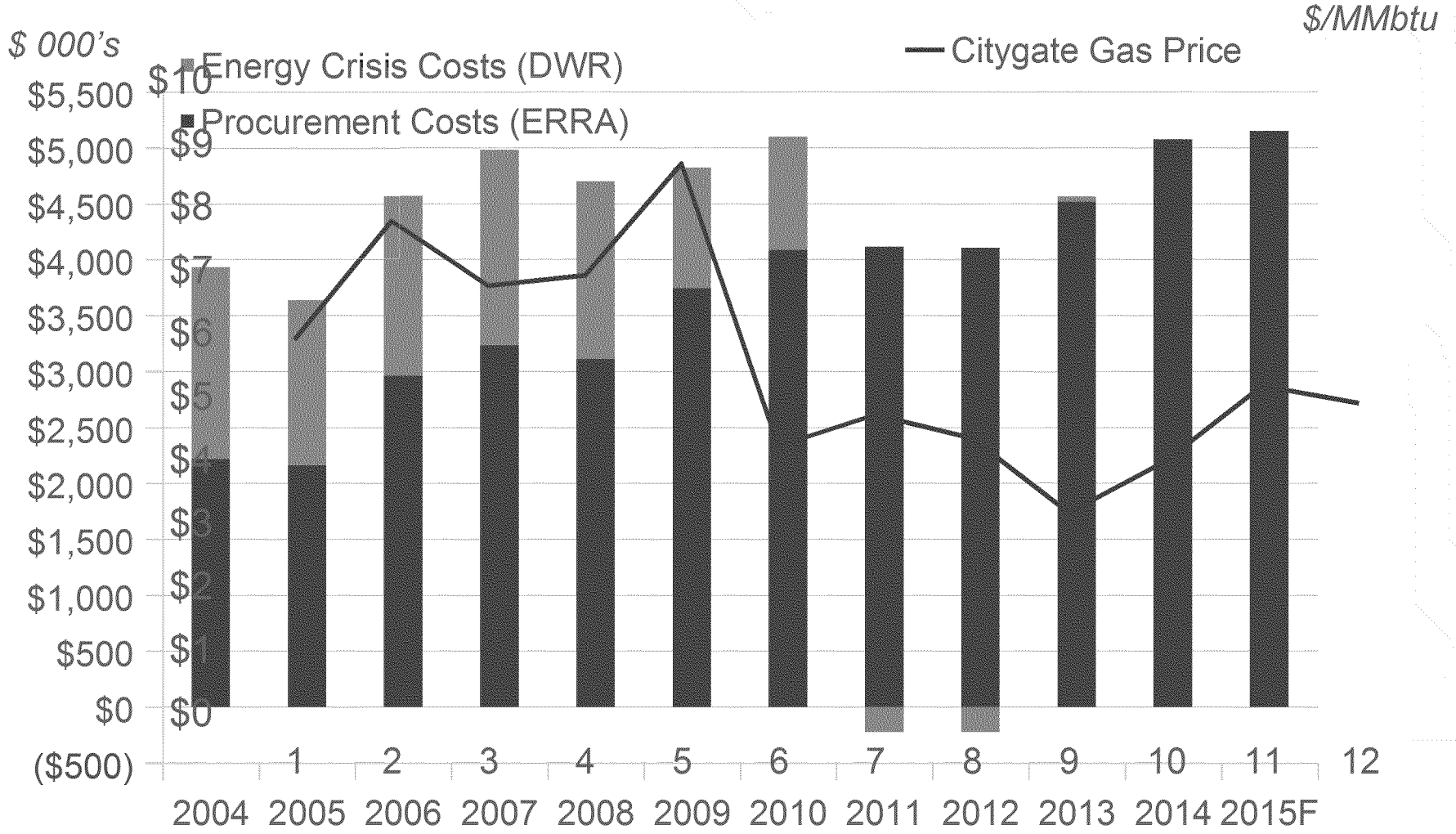


Renewable generation is no longer a technical challenge, but an economic and operational challenge



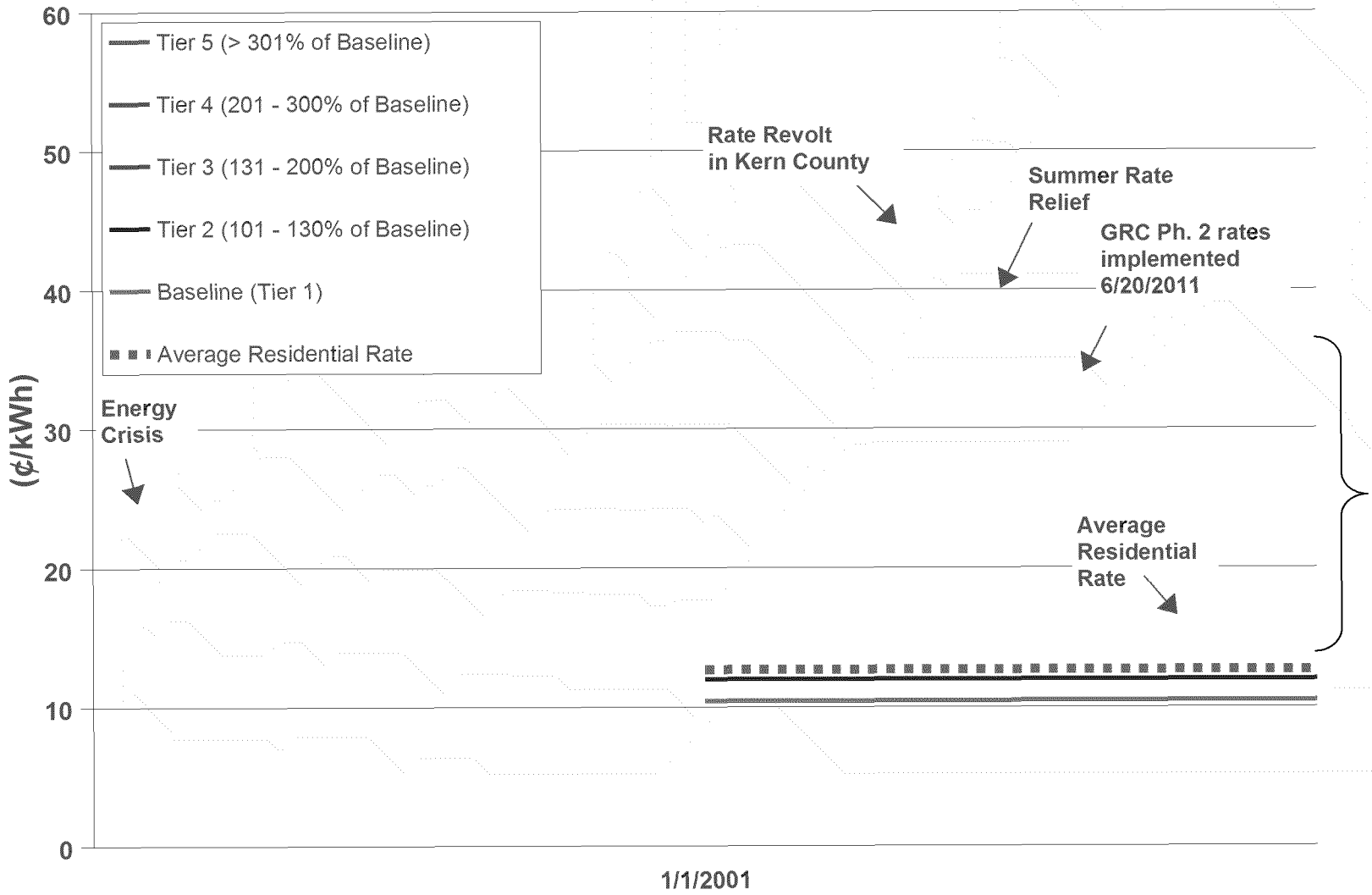


PG&E's Portfolio Costs are Rising





PG&E's Electric Rate History



Data as of May 1, 2014



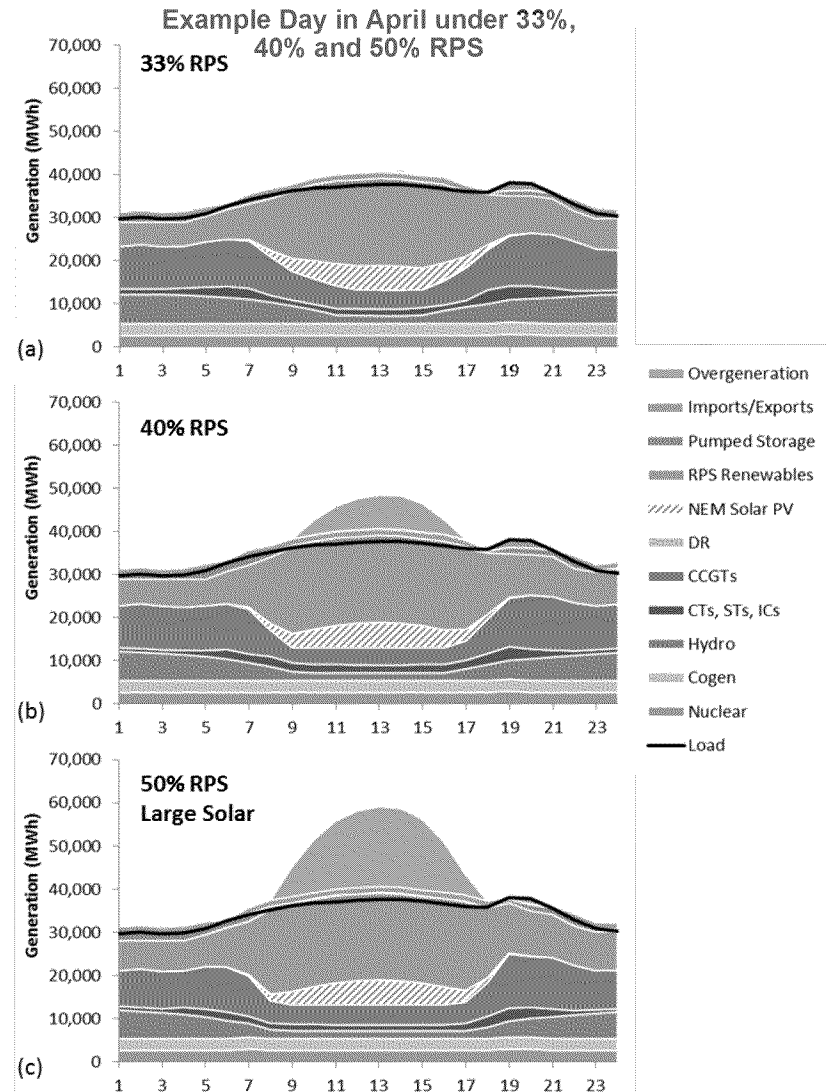
Beyond 33% RPS, Integration is Increasingly Challenging and Costly

PG&E and other large California utilities studied challenges and solutions to implementing a higher RPS

Over-generation emerges as a problem above 33%

- Grid cannot absorb all energy generated
- Over-generation is very high on some days
- Flexible fossil generation helps mitigate daily swings

Without additional solutions, grid operator must curtail solar to maintain reliability



Source: Energy + Environmental Economics

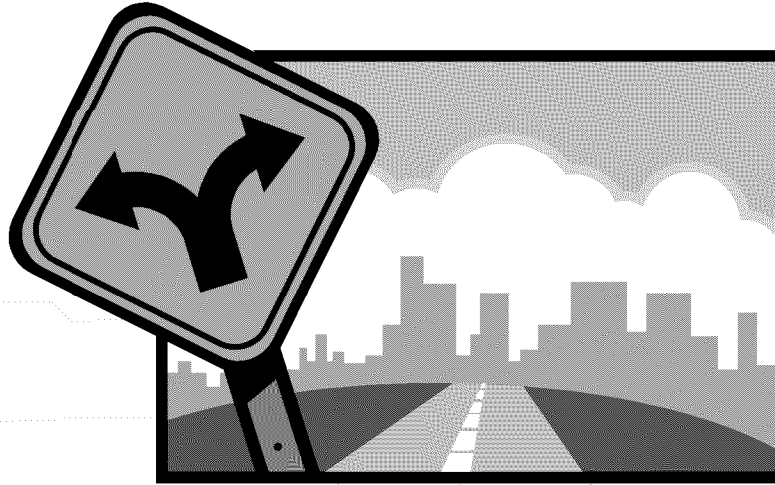
What Does the Future Hold?

**More
renewables?**

More demand response?

More storage?

More EVs?

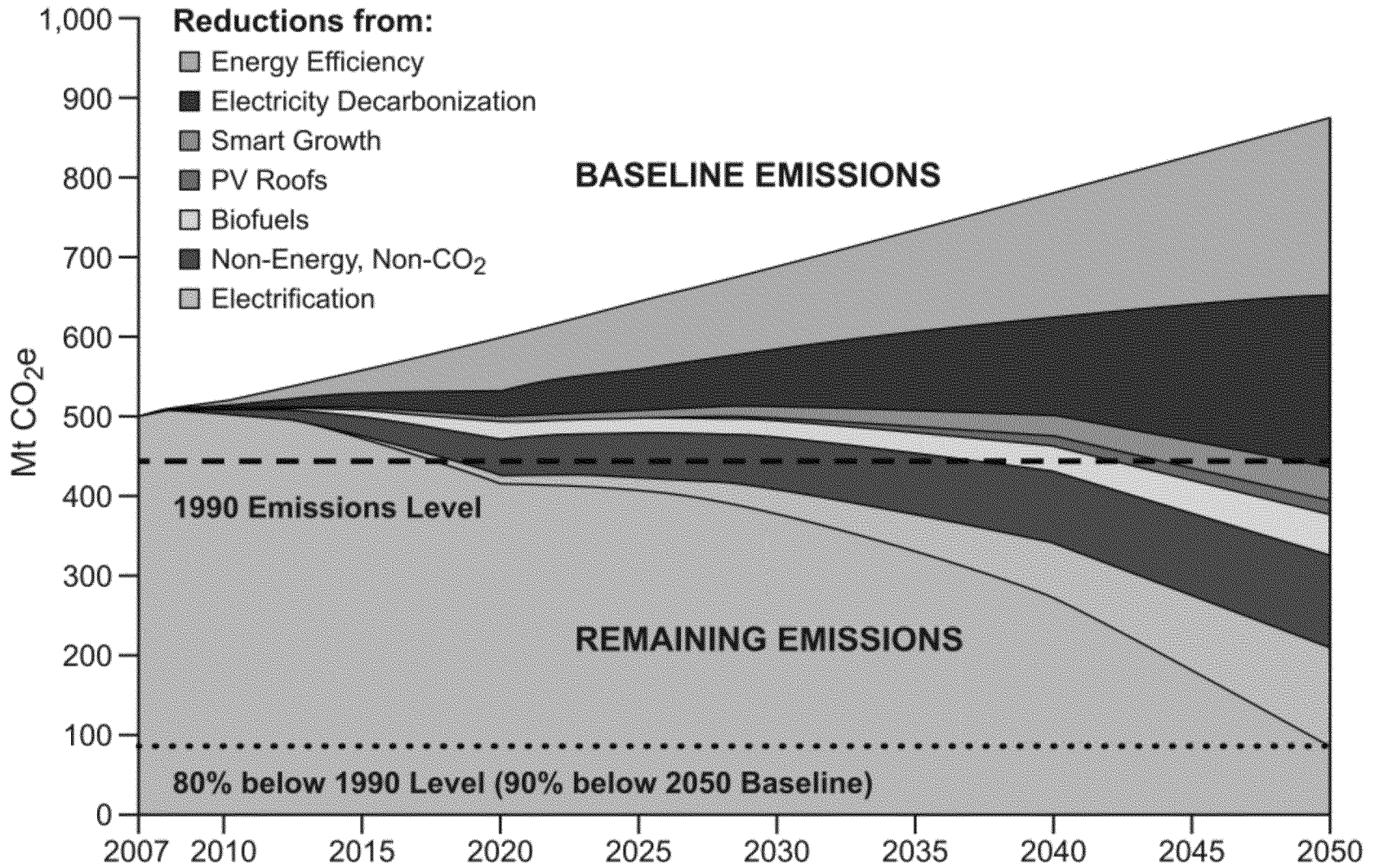


**More energy
efficiency?**

**Will electricity replace
natural gas usage?**



Achieving CA's 2050 GHG Goal



Source: Energy + Environmental Economics



Integration Solutions Will Be Critical to Success

Increased regional coordination

- Make best use of latent flexibility in current system

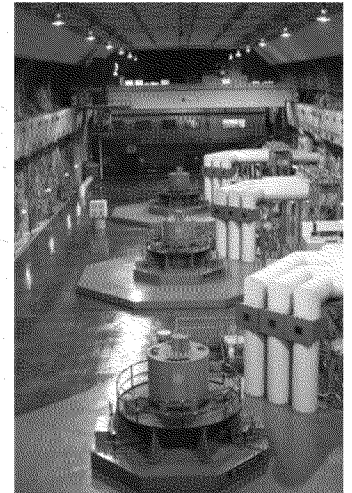


Renewable resource diversity

- Reduces over-generation and need for flexible resources

Flexible loads

- Shifting loads from one time period to another, sometimes on short notice



Flexible generation

- Need generation that is fast ramping, starts quickly, and has minimum generation flexibility

Energy storage

- Deep-draw (diurnal) storage is important

