

# Powering California Forward

## CPUC Thought Leaders Series

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# California, Outlier or Leader?

**Renewables Standard**

• Highest in US, 33% by 2020

**Greenhouse Gas Cap**

• 1990 levels by 2020

**Electric Car Mandate**

• 15% of sales by 2025

**Energy Efficiency**

• Gets first priority in resource planning

**Decoupling**

• Utility profits not tied to sales volume

**Smart Grid**

• One of the earliest & largest adopters of AMI

**Solar Rooftops**

• Goal set for 1 million by 2016

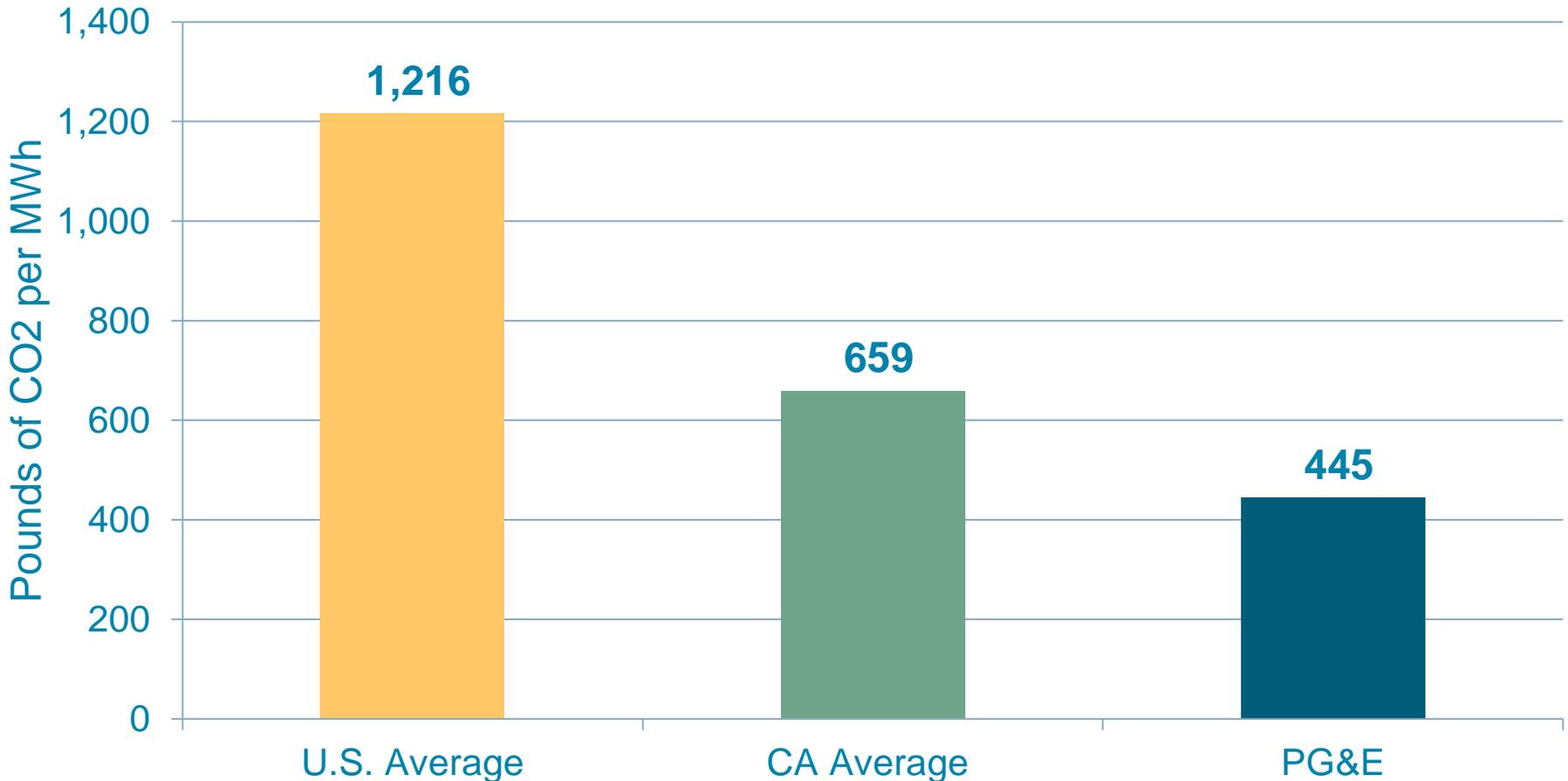
**Nuclear**

• New plants prohibited by state law



# PG&E: Delivering Clean Energy

## CO<sub>2</sub> Emissions for Delivered Electricity



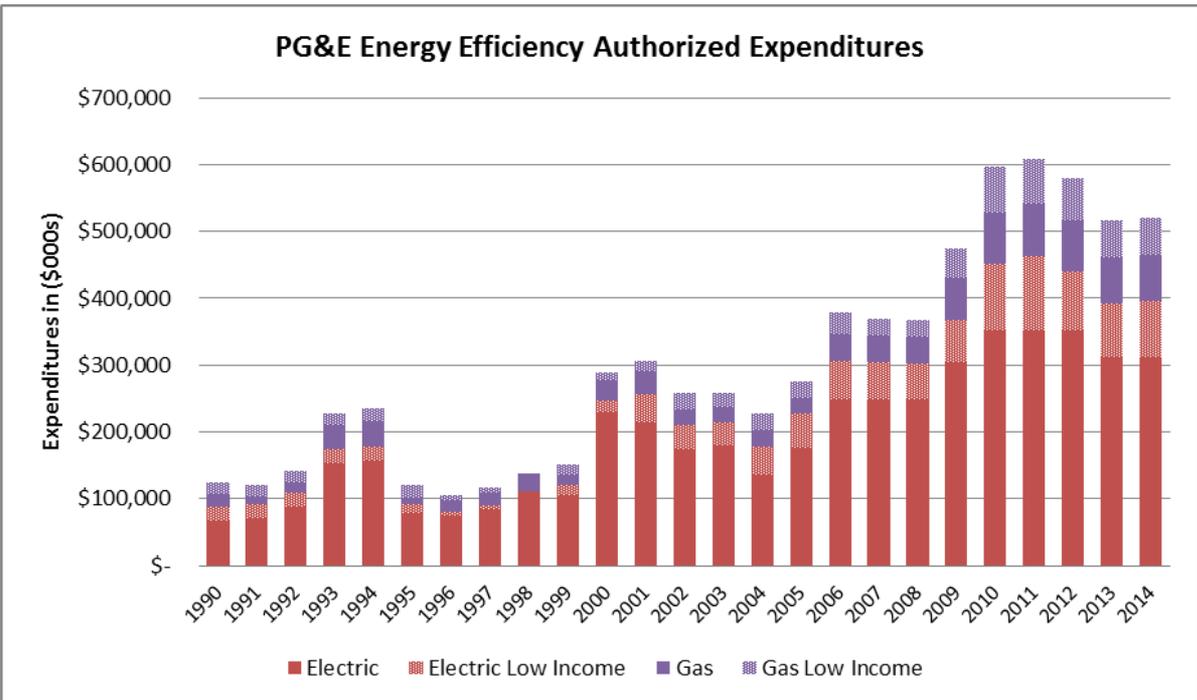
Source: U.S. and CA averages, U.S. Environmental Protection Agency.

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  
Download  
My Data<sup>®</sup>

Online Information



Home Energy Reports

## Smart Markets



Customer Energy Management

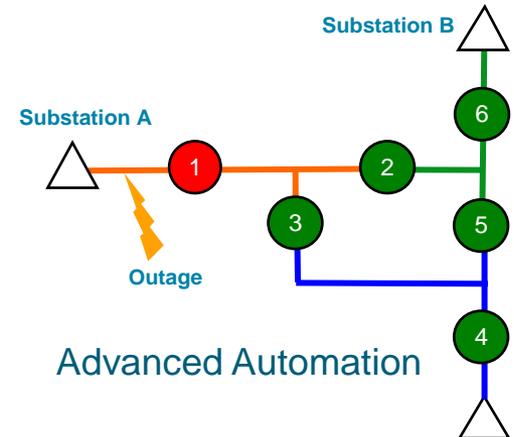


Automated Demand Response

## 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

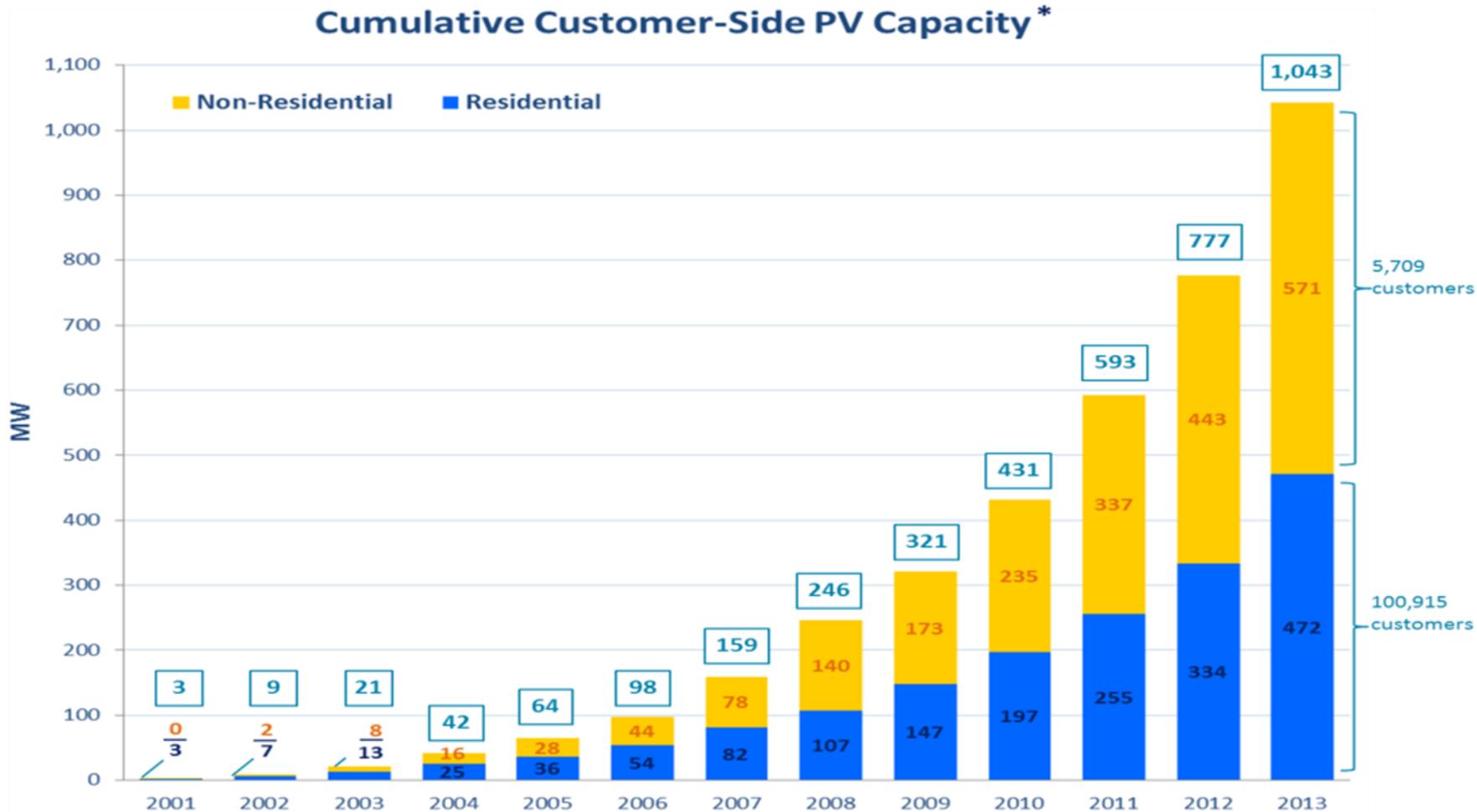
*One-fourth of customer solar installations in the U.S. are in PG&E's service territory*



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



# Customer PV has Grown Significantly

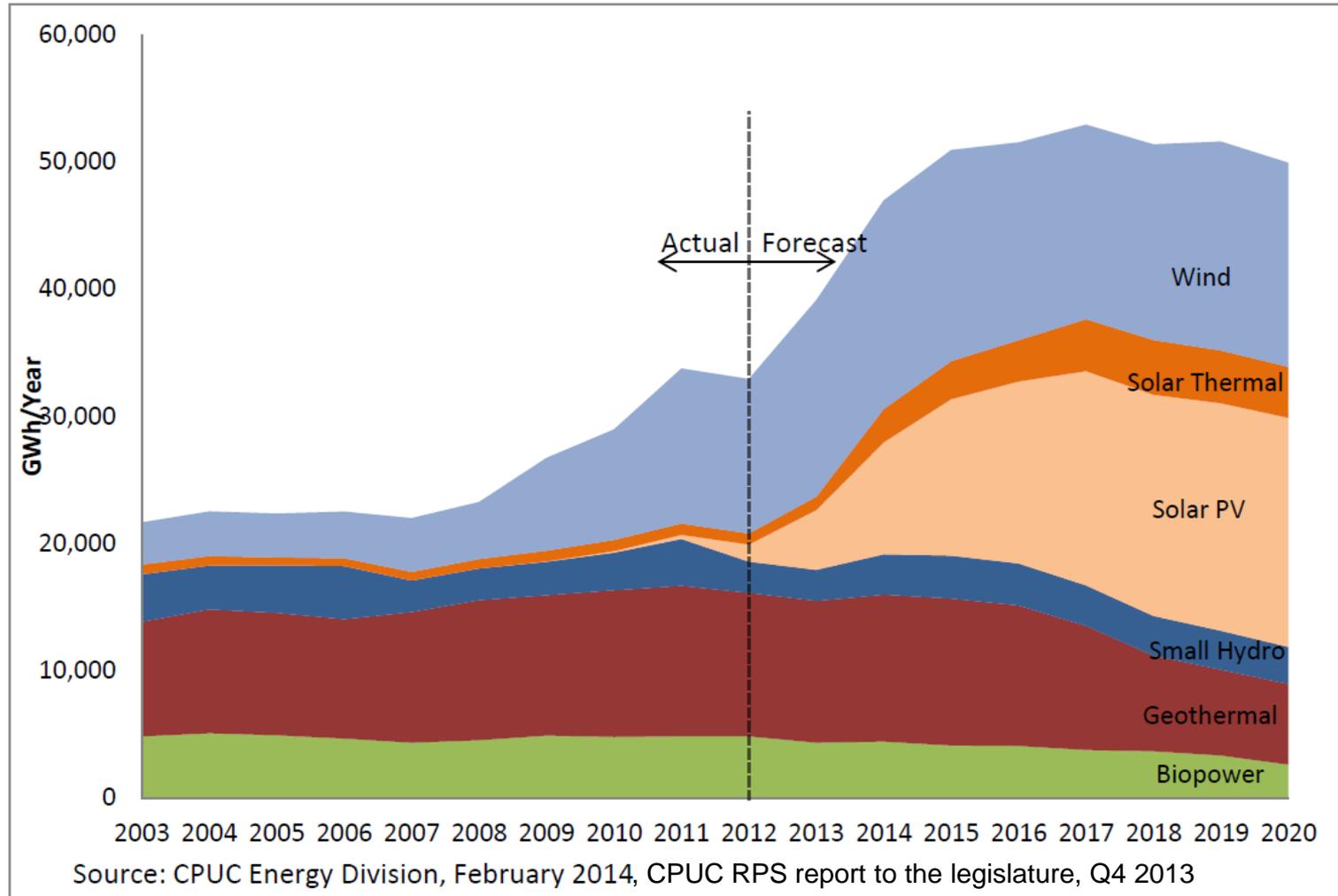


\* Capacity is CEC AC and includes all NEM and non-NEM customer-side PV capacity. Some previous versions of this chart include only NEM capacity, so totals were, on average, 5% lower than above.



# California Utility Scale Renewables<sup>8</sup> Increasing Dramatically

Figure 3: Renewable Resource Mix, Actual and Forecasted by Year<sup>11,12</sup>



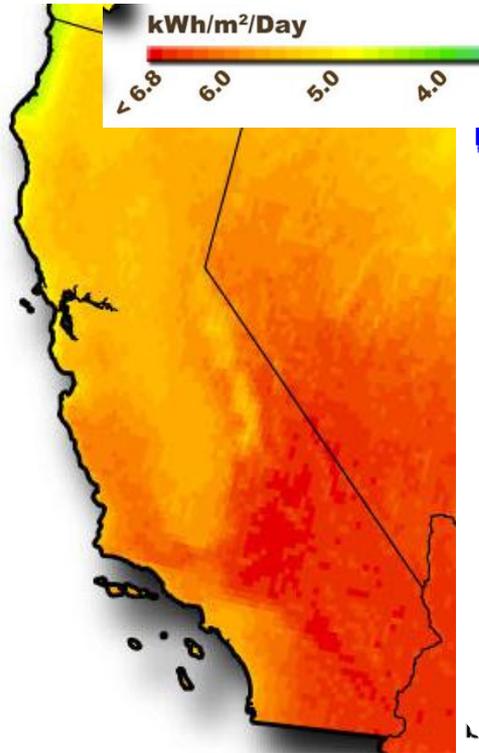
11. Figure is not risk-adjusted and forecast does not assume re-contracting of contracts whose terms expire prior to 2020.

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).

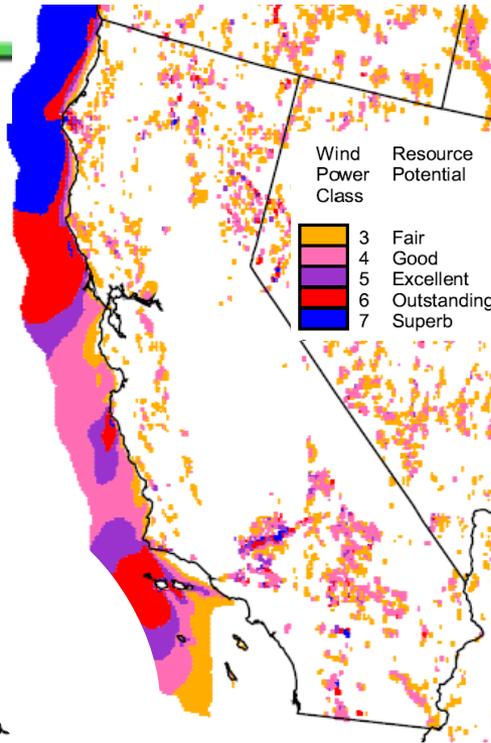


# California is Rich in Renewable Resources

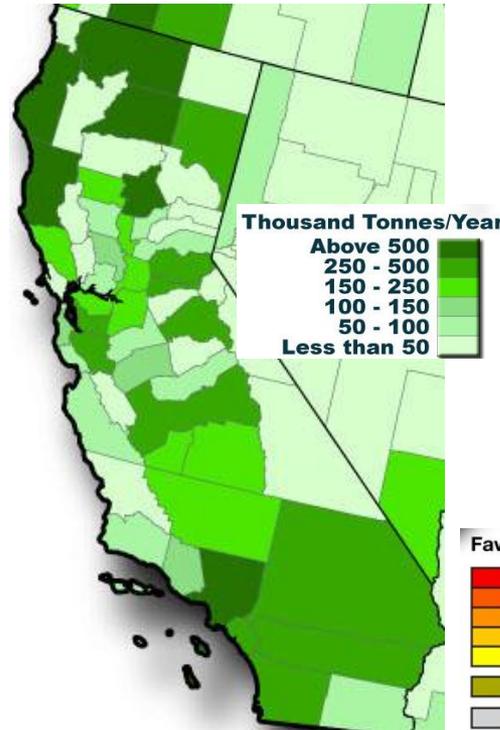
## Solar



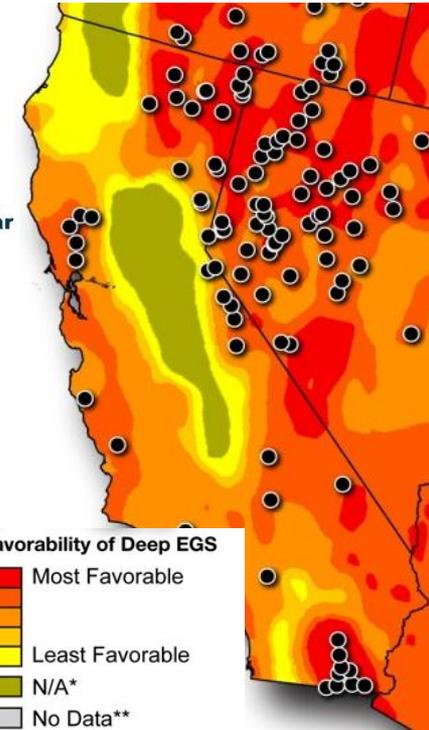
## Wind



## Biomass



## Geothermal



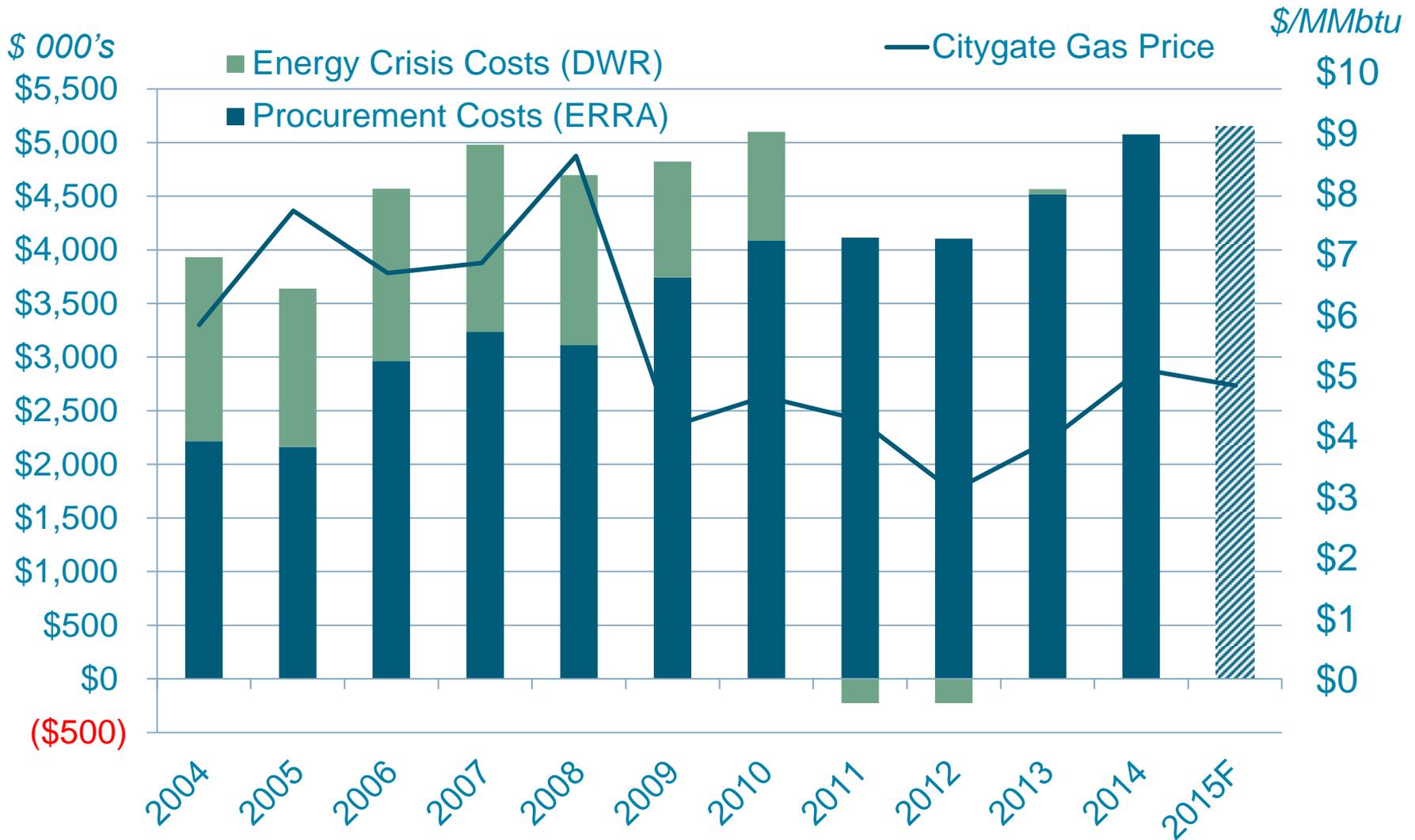


# Renewable generation is no longer a technical challenge, but an economic and operational challenge



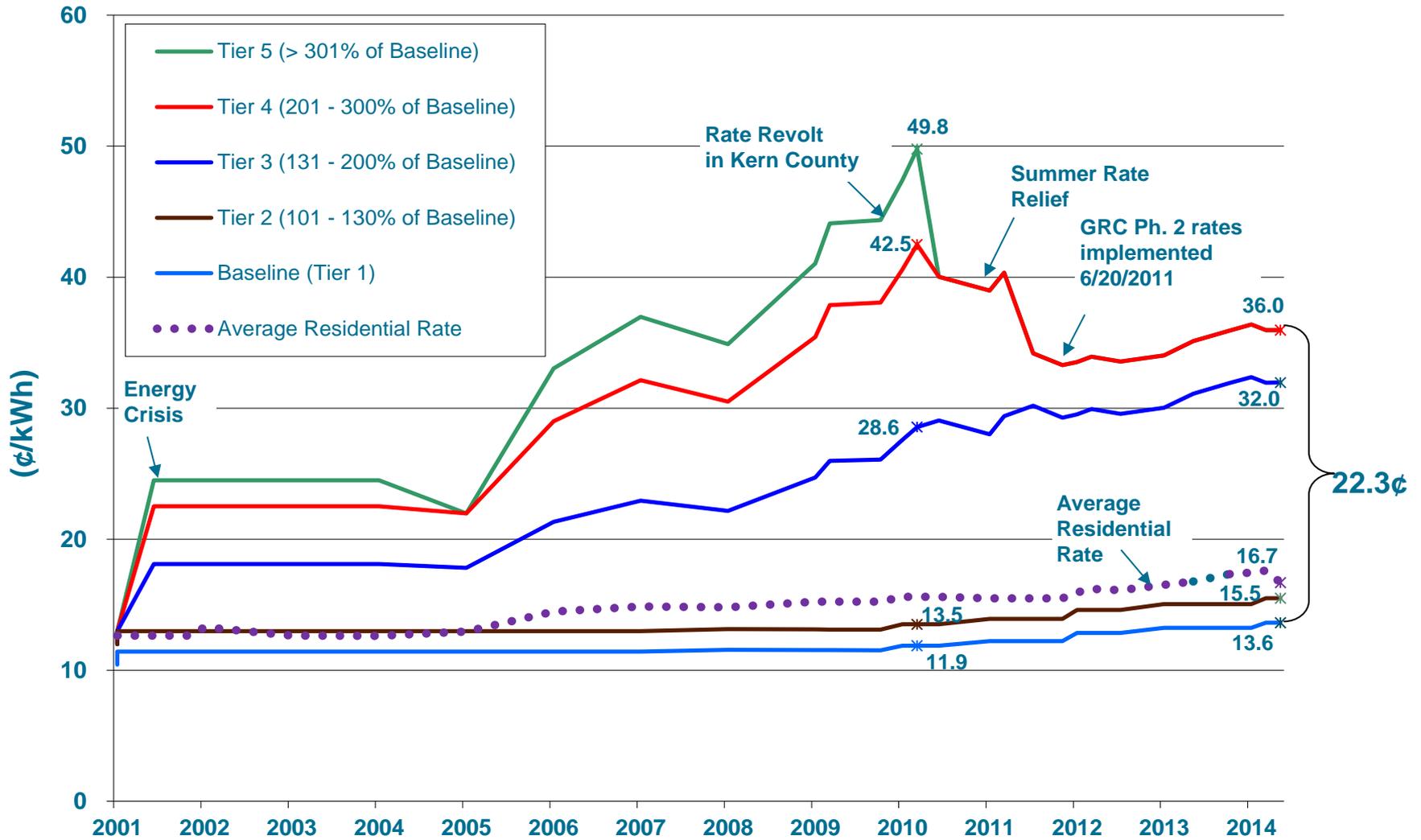


# PG&E's Portfolio Costs are Rising <sup>11</sup>





# PG&E's Electric Rate History



Data as of May 1, 2014



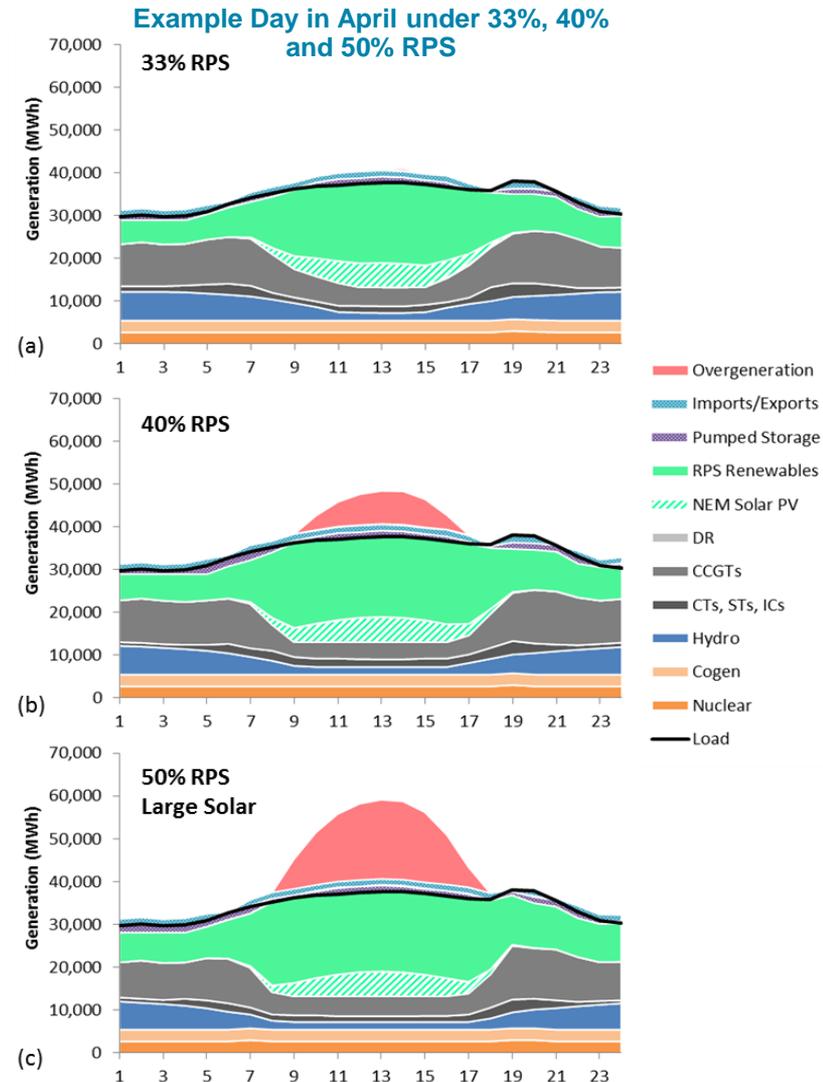
# Beyond 33% RPS, Integration is Increasingly Challenging and Costly

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?



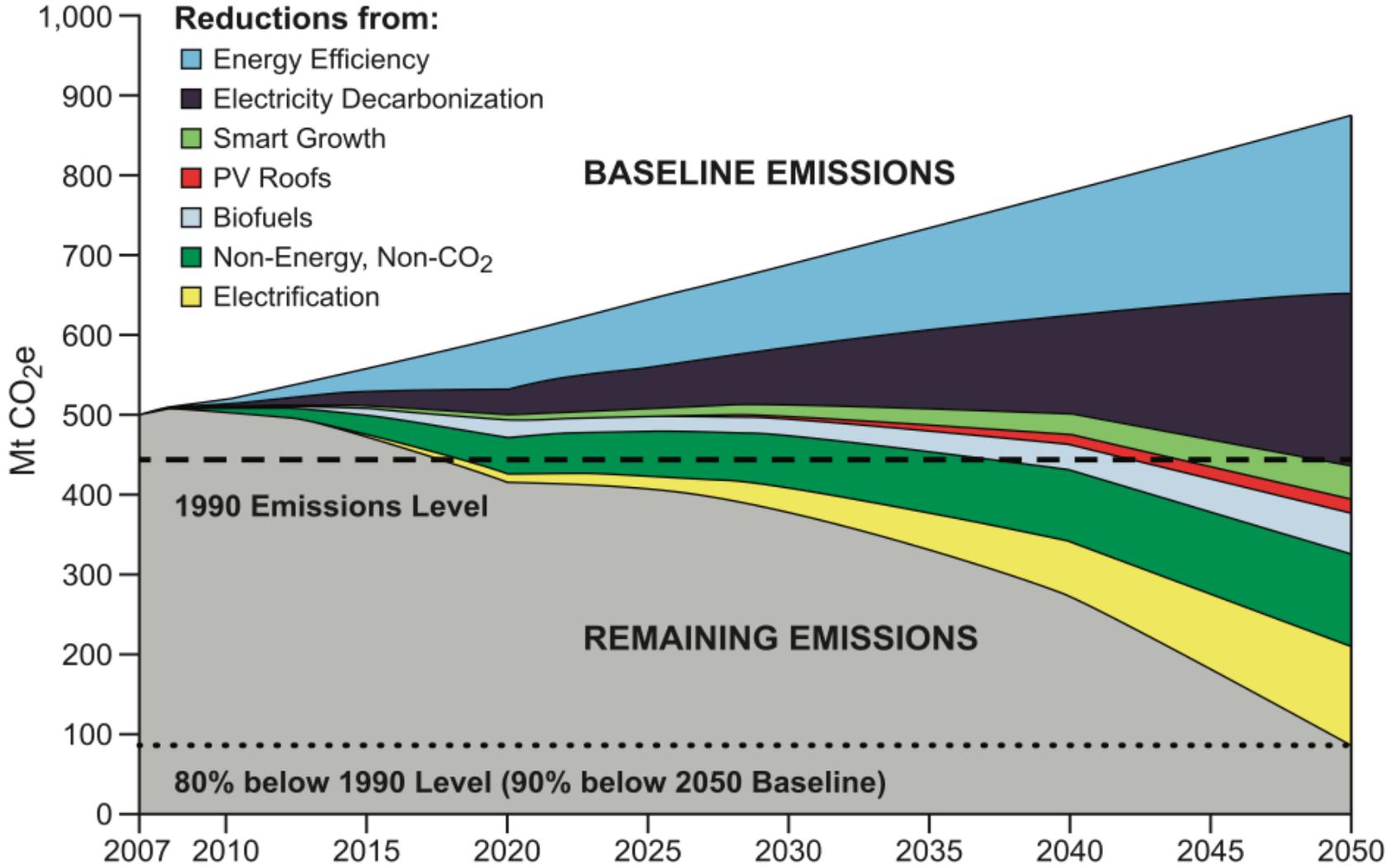
More  
EVs?

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

