# The Design of California's Energy Future

Presentation of

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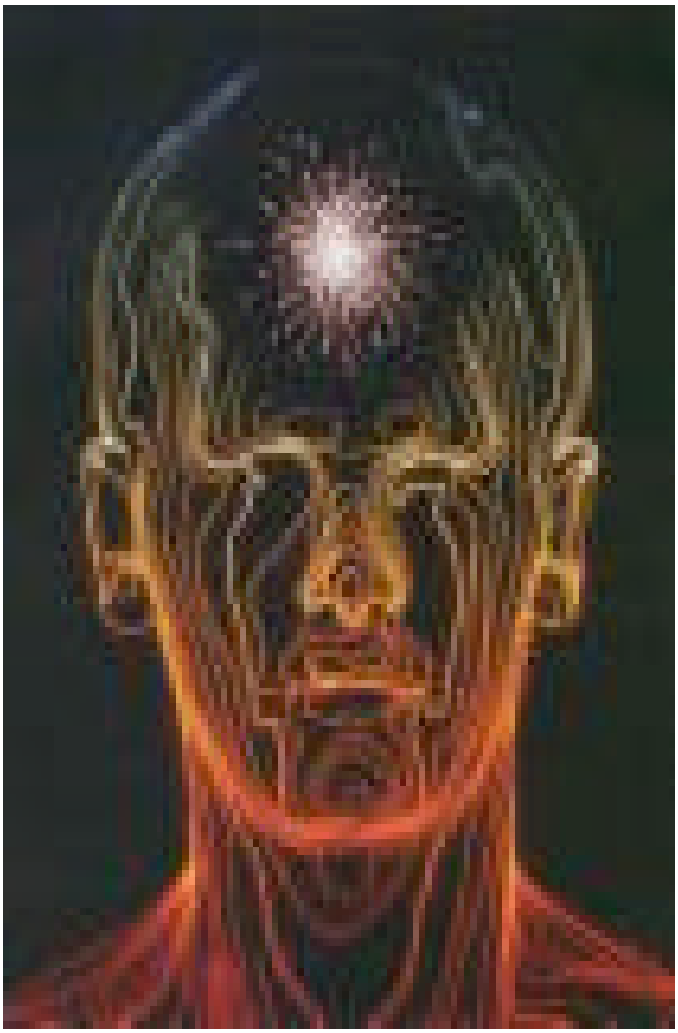
Indian Wells, CA

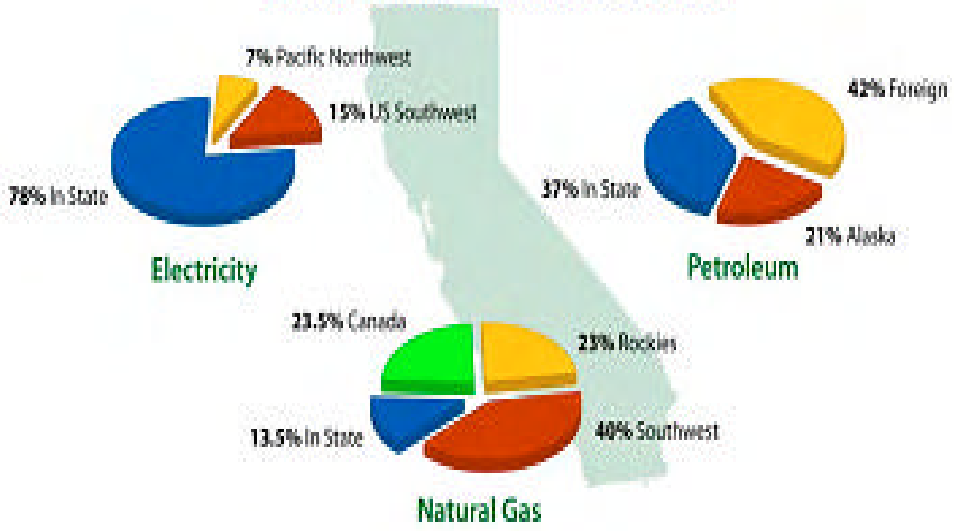
# Contents



- CEC IEPR
  - demand,
  - supply
  - prices
- CPUC
  - water-energy pilots
  - feed-in water agency renewables tariffs
- ARB/GHG
- Legislation
- Recommendations

# The Big Picture

**Figure 1-7: California's Big Picture**




Source: California Energy Commission 2008

# Population Assumptions

Figure 1-4: California's Inland Population Increases

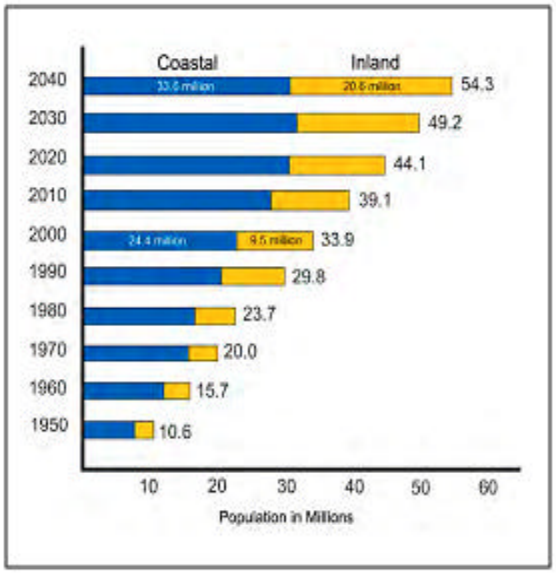
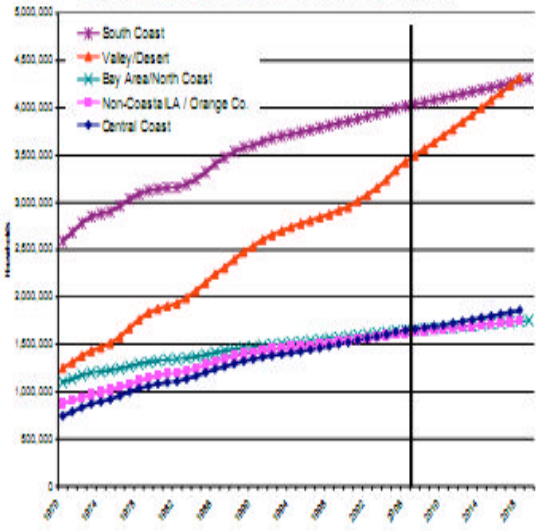
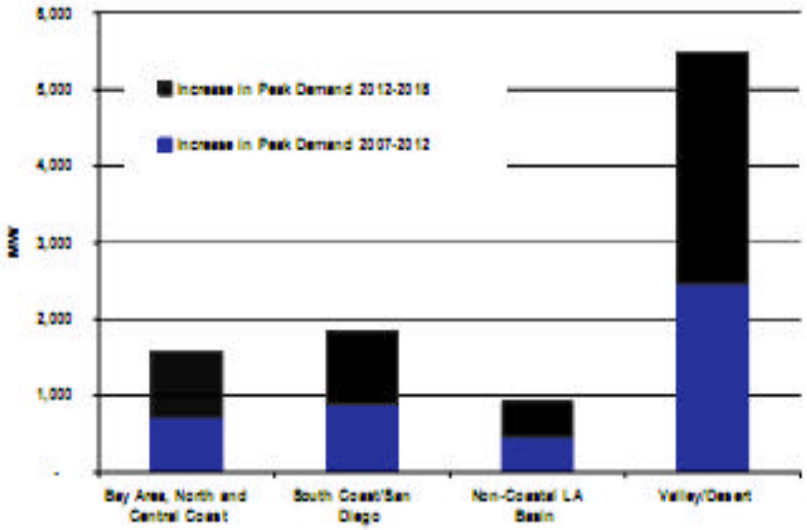



Figure 2-1: Number of Households by Region



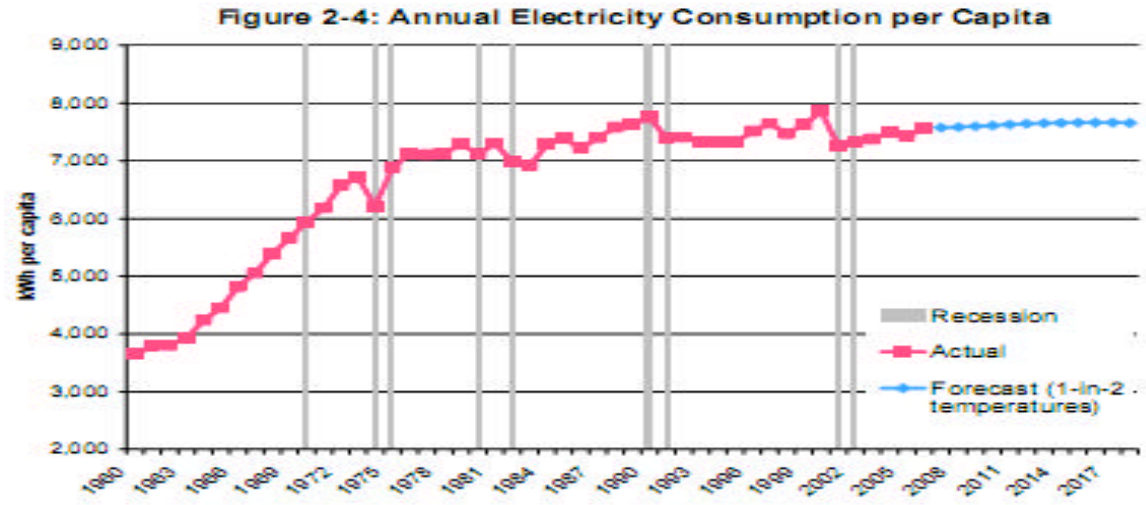

Source: Department of Finance (July 2007) and California Energy Commission

Figure 2-8: Regional Growth in Peak Demand (megawatts)

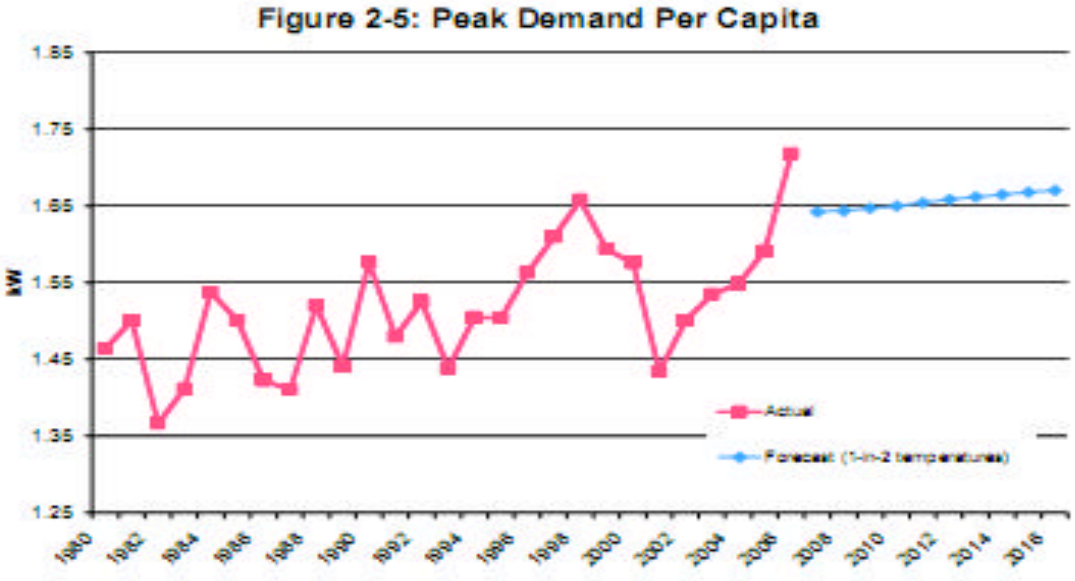



Source: California Energy Commission, *California Energy Demand 2008–2018*, CEC-200-2007-015SF

# Peak/Electricity Demand Assumptions




Source: California Energy Commission *California Energy Demand 2008–2018*, CEC-200-2007-015-SF




Source: California Energy Commission *California Energy Demand 2008–2018*, CEC-200-2007-015-SF

# California Demand Forecasts

**Figure ES-2: Statewide Non-Coincident Peak Demand**

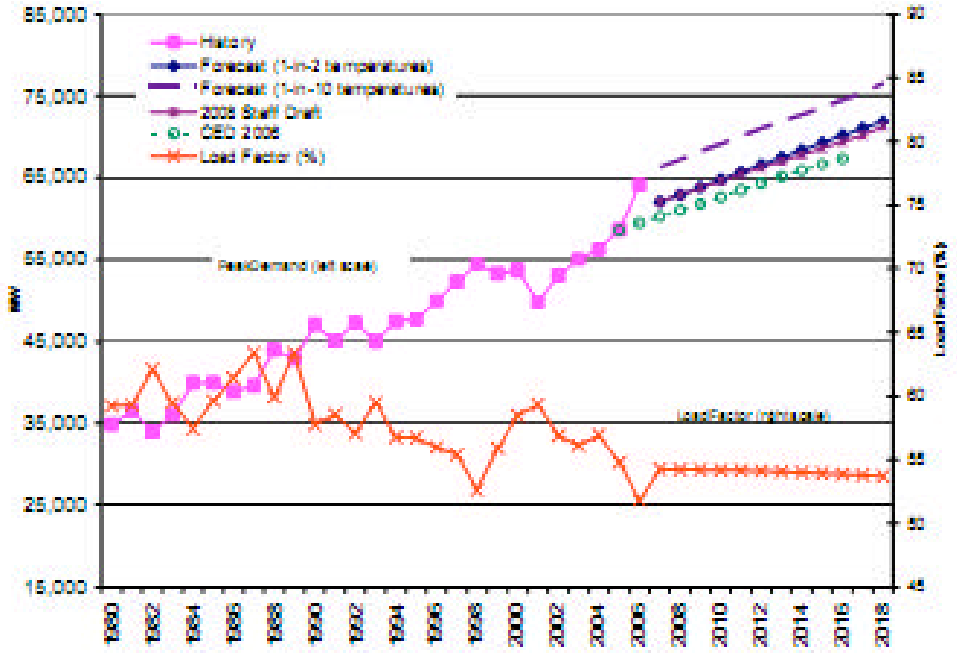
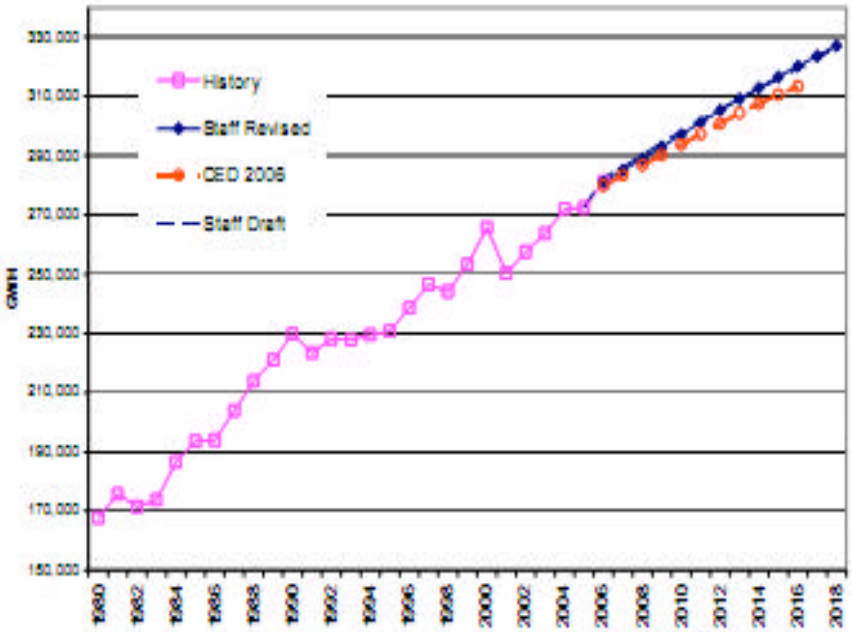



**Figure ES-1: Statewide Electricity Consumption**



# Generation Plants Status

Figure 2-23: Power Plant Application Status 1999–2008

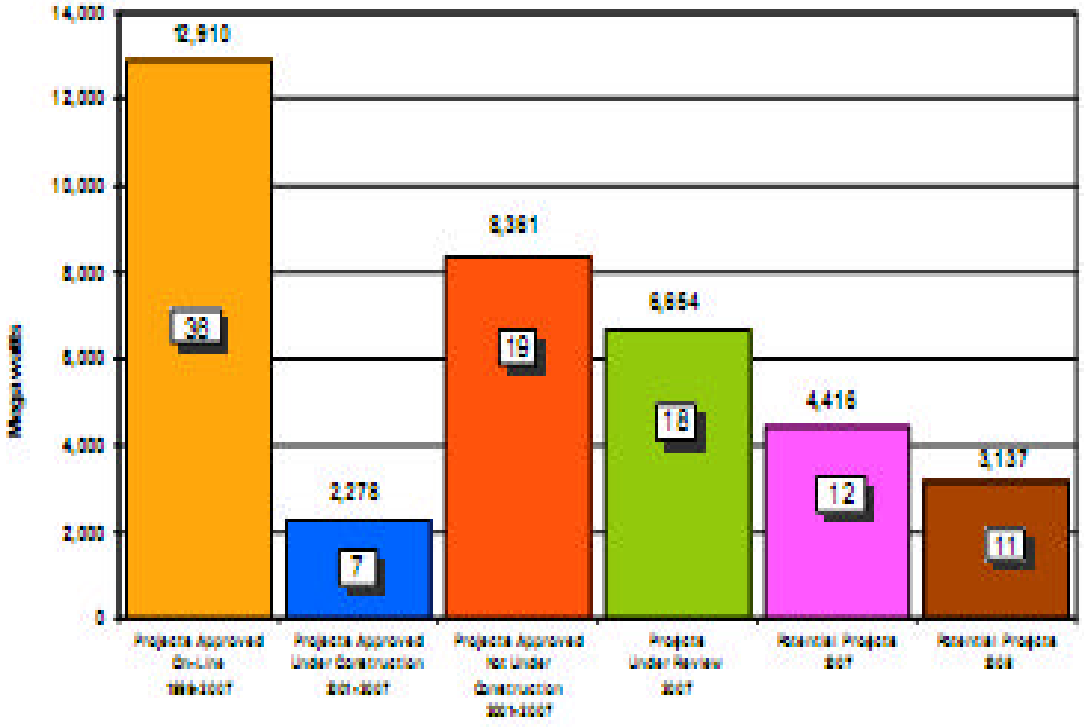


Figure 4-3: Progress Toward California's Renewable Energy Goals

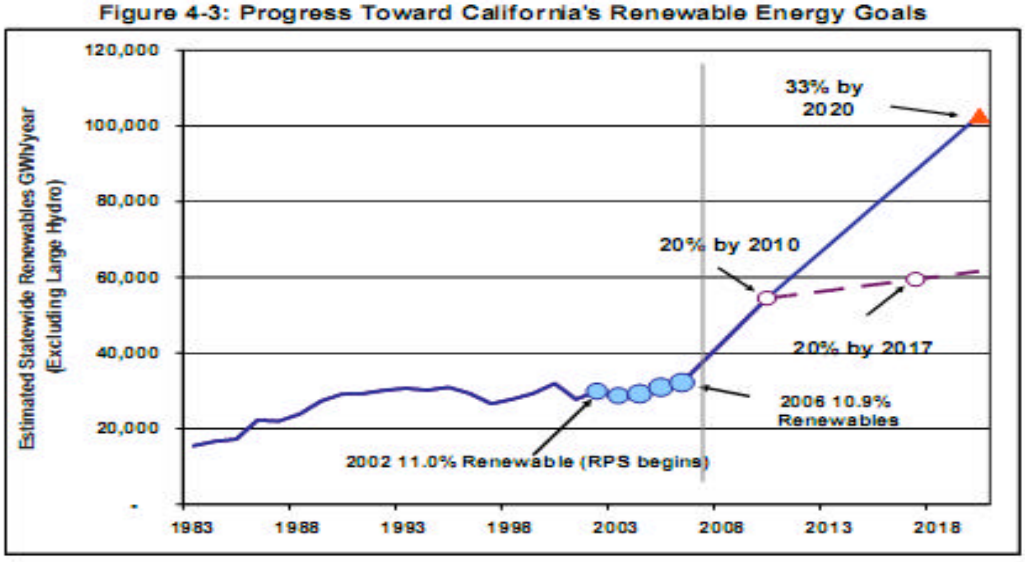
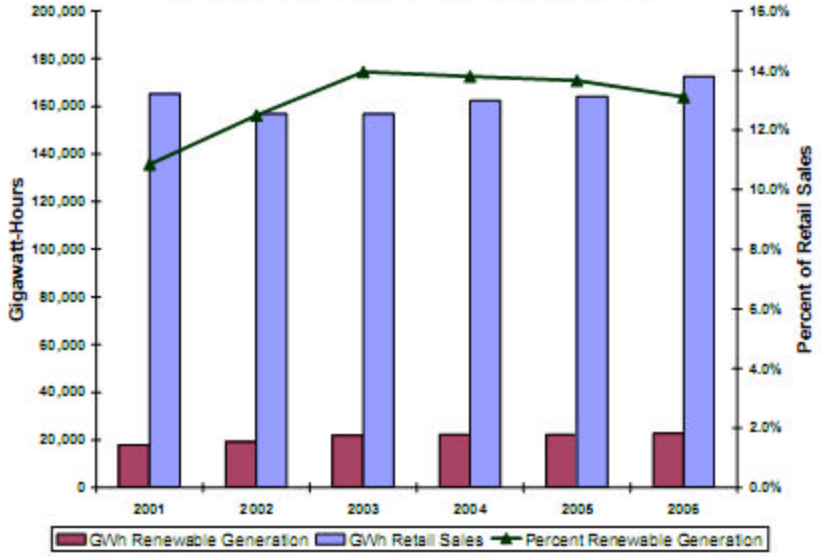
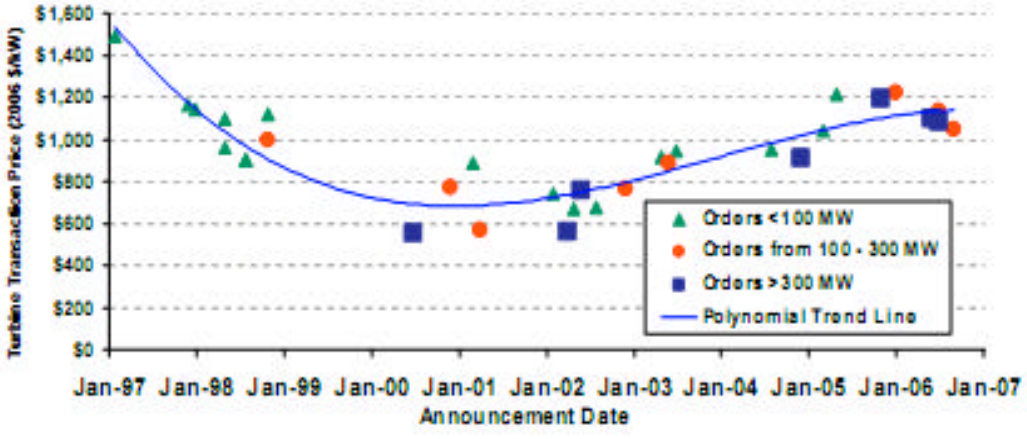



Figure 4-4: Progress of Large Investor-Owned Utilities toward 20 Percent Renewable Energy by 2010 (GWh/year, Percent)




Source: California Energy Commission

Figure 4-7: Wind Turbine Transaction Prices in the U.S. Market



# Prices

- Natural Gas

Figure 2-11: Expected Range of Natural Gas Prices ($2006)

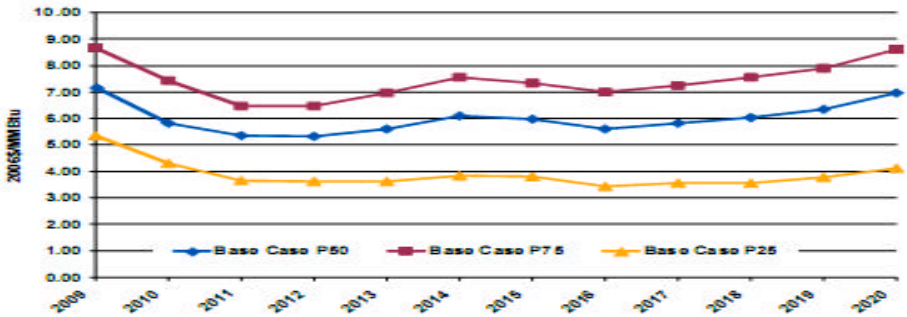



Table 2-4: Reported Natural Gas Prices
(95th Percentile, Nominal $)

| | 2010 | 2013 | 2016 |
|---|---|---|---|
| PG&E | $17.09 | $16.30 | $17.21 |
| SCE | $10.21 | $10.61 | $11.87 |
| SDG&E | $11.06 | $9.90 | $9.36 |

Source Investor-Owned Utility Long-Term Procurement Plans filed with the CPUC December 11, 2006.

- Electricity - assume to escalate at the rate of inflation

# CPUC Water-Energy Pilots

| Adopted Programs, Evaluations and Studies | | |
|---|---|---|
| **Programs** | | **Adopted $** |
| SCE | Low Income Direct Install HET (multifamily) | $200,000 |
| | Express Water Efficiency | $133,000 |
| | Lake Arrowhead Water Conservation | $176,500 |
| | Water Leakage | $300,000 |
| PG&E | Large Commercial Customer | $700,000 |
| | Low Income Single Family HET Replacement | $200,000 |
| | Emerging Technologies in Water Utility Efficiency | $341,000 |
| SDG&E | Managed Landscape | $250,000 |
| | Large Industrial Customer Audits | $498,000 |
| | Recycled Water | $250,000 |
| SCG | CLAVA/AEM/WD Gas Pump Testing | $436,407 |
| total | | $3,482,907 |
| **Evaluations*** | | |
| | Commercial and Industrial Pilot Programs | |
| | I. \Commercial programs (PG&E) | $120,000 |
| | II. Industrial Audits/Express Efficiency (SCE) | $50,000 |
| | III. Industrial Water Audits (SDG&E) | $75,000 |
| | HET Replacement Programs (Single and multifamily) (PG&E and SCE) | $250,000 |
| | Weather-Based Irrigation Controller Programs (SDG&E and SCE) | $50,000 |
| | Emerging Technologies (PG&E) | $100,000 |
| | Residential Indoor/Outdoor for Lake Arrowhead SCE) | $84,000 |
| | Leak Detection(SCE) | $50,000 |
| | Recycled Water(SDG&E) | $50,000 |
| total | | $812,000 |
| **Studies** | **Studies** | |
| | Load Profile (all energy utilities) | $475,300 |
| | Toilet Flapper (all energy utilities) | $220,000 |
| | Statewide/Regional Water-Energy Relationship | $425,000 |
| | Water Agency (Function Component | $650,000 |
| total | | $1,770,300 |
| **Total** | total evaluation and studies ($M&V) | $2,582,300 |
| | Total Pilot (Pilots + Evals + Studies) | $6,065,207 |

*Evaluations refers to impact evaluations to be overseen by Energy Division. Process evaluations will be conducted by the utilities and will consist of 5% of the approved individual program budgets.

# Water Agencies Renewable Generation Tariff

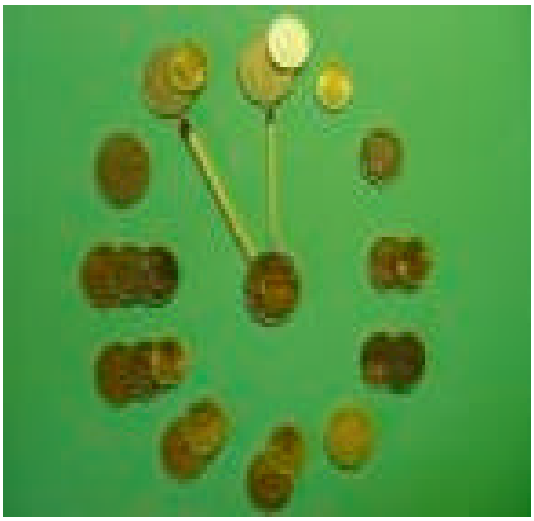
- AB 1969 implementation
- SCE's Advice Letter pulled due to protests - should look like PG&E's
- PG&E's approved
  - Tariff E-PWF - power purchase arrangement
  - first 104.63 MW
  - PG&E does the scheduling
  - standard interconnection requirements
  - full buy sell or excess sale
  - 10, 15, or 20 year contract
  - PG&E gets all renewables attributes
  - Can't use SGIP or CSI grants
  - Price is MPR time differentiated

# Current MPR (Market Price Reference)

| Adopted 2007 Market Price Referents[1] (Nominal - dollars/kWh) | | | |
|---|---|---|---|
| **Resource Type** | **10-Year** | **15-Year** | **20-Yea** |
| 2008 Baseload MPR | 0.09271 | 0.09383 | 0.09572 |
| 2009 Baseload MPR | 0.09302 | 0.09475 | 0.09696 |
| 2010 Baseload MPR | 0.09357 | 0.09591 | 0.09840 |
| 2011 Baseload MPR | 0.09412 | 0.09696 | 0.09969 |
| 2012 Baseload MPR | 0.09518 | 0.09844 | 0.10139 |
| 2013 Baseload MPR | 0.09605 | 0.09965 | 0.10275 |
| 2014 Baseload MPR | 0.09722 | 0.10107 | 0.10430 |
| 2015 Baseload MPR | 0.09872 | 0.10274 | 0.10606 |
| 2016 Baseload MPR | 0.10053 | 0.10466 | 0.10804 |
| 2017 Baseload MPR | 0.10269 | 0.10685 | 0.11143 |
| 2018 Baseload MPR | 0.10478 | 0.11016 | 0.11489 |
| 2019 Baseload MPR | 0.10818 | 0.11370 | 0.11720 |
| 2020 Baseload MPR | 0.11172 | 0.11603 | 0.11954 |

[1] Note: using 2008 as the base year, Staff calculates MPRs for 2008-2020 that reflect differ
Model: http://www.ethree.com/MPR.html

# Time Differentiated Prices



**2008 MPR Values (With GHG "adder")**

| PG&E | TOU Factor | | | | Price Paid* | | | |
|---|---|---|---|---|---|---|---|---|
| | Super Peak | Shoulder | Night | | Super Peak | Shoulder | Night | |
| Jun-Sep | 1.959 | 0.903 | 0.626 | | $ 0.1875 | $ 0.0864 | $ 0.0599 | |
| Oct-Feb | 1.471 | 10.3 | 0.731 | | $ 0.1408 | $ 0.9859 | $ 0.0700 | |
| Mar-May | 1.319 | 0.843 | 0.584 | | $ 0.1263 | $ 0.0807 | $ 0.0559 | |
| | | | | | | | | |
| | | | | | * 2008 MPR (20 yr) = | $ 0.09572 | | |

| SCE | TOU Factor | | | | Price Paid* | | | |
|---|---|---|---|---|---|---|---|---|
| | On-Peak | Mid-Peak | Off-Peak | Super Off-Peak | On-Peak | Mid-Peak | Off-Peak | Super Off-Peak |
| Summer | 3.28 | 1.28 | 0.67 | NA | $ 0.3140 | $ 0.1225 | $ 0.0641 | NA |
| Winter | NA | 1.02 | 0.82 | 0.65 | NA | $ 0.0976 | $ 0.0785 | $ 0.0622 |
| | | | | | | | | |
| | | | | | * 2008 MPR (20 yr) = | $ 0.09572 | | |

**2008 MPR Values (With GHG "adder")**

| PG&E | TOU Factor | | | | Price Paid* | | | |
|---|---|---|---|---|---|---|---|---|
| | Super Peak | Shoulder | Night | | Super Peak | Shoulder | Night | |
| Jun-Sep | 1.959 | 0.903 | 0.626 | | $ 0.1816 | $ 0.0837 | $ 0.0580 | |
| Oct-Feb | 1.471 | 10.3 | 0.731 | | $ 0.1364 | $ 0.9549 | $ 0.0678 | |
| Mar-May | 1.319 | 0.843 | 0.584 | | $ 0.1223 | $ 0.0782 | $ 0.0541 | |
| | | | | | | | | |
| | | | | | * 2008 MPR (10 yr) = | $ 0.09271 | | |

| SCE | TOU Factor | | | | Price Paid* | | | |
|---|---|---|---|---|---|---|---|---|
| | On-Peak | Mid-Peak | Off-Peak | Super Off-Peak | On-Peak | Mid-Peak | Off-Peak | Super Off-Peak |
| Summer | 3.28 | 1.28 | 0.67 | NA | $ 0.3041 | $ 0.1187 | $ 0.0621 | NA |
| Winter | NA | 1.02 | 0.82 | 0.65 | NA | $ 0.9740 | $ 0.0760 | $ 0.0603 |
| | | | | | | | | |
| | | | | | * 2008 MPR (10 yr) = | $ 0.09271 | | |

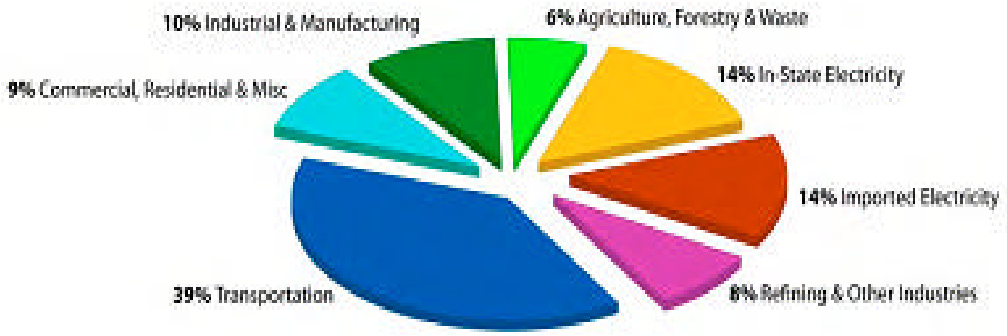
# Water Industry .002 of Total CA GHG

| Last Updated: 8/22/2007 12:40:14 PM | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 - WASTE | 7.41 | 7.15 | 7.42 | 7.43 | 7.46 | 7.01 | 6.90 | 6.86 | 7.07 | 7.05 | 6.82 | 6.91 | 6.79 | 6.87 | 6.88 |
| 4A - Solid Waste Disposal | 6.58 | 6.29 | 6.54 | 6.54 | 6.56 | 6.10 | 5.98 | 5.92 | 6.12 | 6.06 | 5.82 | 5.89 | 5.78 | 5.83 | 5.83 |
| 4A1 - Managed Waste Disposal Sites | 6.58 | 6.29 | 6.54 | 6.54 | 6.56 | 6.10 | 5.98 | 5.92 | 6.12 | 6.06 | 5.82 | 5.89 | 5.78 | 5.83 | 5.83 |
| 4D - Wastewater Treatment and Discharge | 0.83 | 0.86 | 0.87 | 0.89 | 0.91 | 0.91 | 0.92 | 0.94 | 0.95 | 0.99 | 1.00 | 1.02 | 1.01 | 1.04 | 1.05 |
| 4D1 - Domestic Wastewater Treatment and Discharge | 0.83 | 0.86 | 0.87 | 0.89 | 0.91 | 0.91 | 0.92 | 0.94 | 0.95 | 0.99 | 1.00 | 1.02 | 1.01 | 1.03 | 1.05 |
| 4D2 - Industrial Wastewater Treatment and Discharge | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

Summary of Categories Included in the Inventory.

| | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Gross California Emissions | 441.81 | 430.34 | 433.72 | 425.97 | 449.95 | 431.26 | 439.79 | 453.15 | 472.75 | 480.54 | 483.74 | 493.76 | 489.31 | 477.77 | 499.08 |

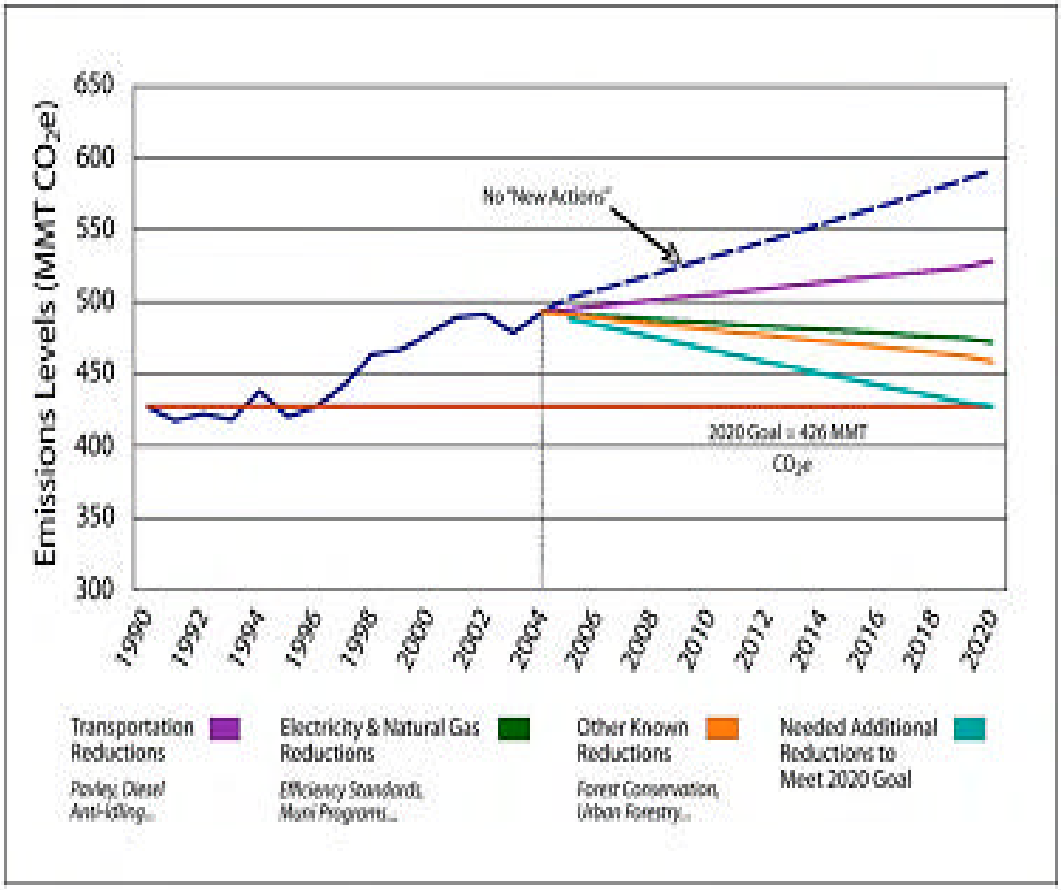
**Figure 1-3: California Greenhouse Gas Emissions in 2004**




Source: California Air Resources Board, *Draft Greenhouse Gas Emissions Inventory*, August 2007

# Can We Meet The GHG Goals?

**Figure 1-2: Reaching for the AB 32 Target**




Source: California Energy Commission, Climate Action Team data

# Who Has To Report

- Direct vs. Indirect Emissions
- “This regulation applies to electric retail providers operating in California, and to operators of the following facilities operating in California:
- (1) Cement plants;
- (2) Petroleum refineries;
- (3) Hydrogen production facilities that emit greater than or equal to 25,000 metric tonnes per year of CO2 from the combination of stationary combustion sources and hydrogen production processes;
- (4) Electric generating facilities with generating capacity rated = 1 megawatt (MW), including hybrid generating facilities and excluding generating facilities that are solely nuclear, hydroelectric, wind, or solar powered;
- (5) Cogeneration facilities with electricity generating capacity =1MW or within the operational control of another facility subject to this article;
- (6) Any individual facility, except a hospital identified as SIC 8069 and school identified as SIC 8299, within California that emits greater than or equal to 25,000 metric tonnes per year of CO2 resulting from stationary combustion sources.”

# Emission Factors

**95113(o)(1) Wastewater Treatment**

| Default MCF Values for Industrial Wastewater | | | |
|---|---|---|---|
| **Type of Treatment and discharge pathway or system** | **Comments** | **MCF** | **Range** |
| **Untreated** | | | |
| Sea, river and lake discharge | Rivers with high organic loading may turn anaerobic, however this is not considered here | 0.1 | 0 0.2 |
| **Treated** | | | |
| Aerobic treatment plant | Well maintained, some $CH_4$ may be emitted from settling basins | 0 | 0 – 0.1 |
| Aerobic treatment plant | Not well maintained, overloaded | 0.3 | 0.2 – 0.4 |
| Anaerobic digester for sludge | $CH_4$ recovery not considered here | 0.8 | 0.8 – 1.0 |
| Anaerobic reactor | $CH_4$ recovery not considered here | 0.8 | 0.8 – 1.0 |
| Anaerobic shallow lagoon | Depth less than 2 meters | 0.2 | 0 – 0.3 |
| Anaerobic deep lagoon | Depth more than 2 meters | 0.8 | 0.8 – 1.0 |

MCF = methane correction factor – the fraction of waste treated anaerobically

$B_0$ = maximum CH4 producing capacity (kg CH4/kg COD)
Default factor = 0.25 kg $CH_4$/kg COD

COD = chemical oxygen demand (kg COD/$m^3$)
Default factor = 1.0 kg COD/$m^3$

$EF_{N2O}$ = 0.005 kg $N_2O$-N/kg-N (Range 0.0005 – 0.25)

Source: IPCC 2006, IPCC, 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 5, Waste, Chapter 6: Wastewater Treatment and Discharge. Prepared by the National Greenhouse Gas Inventories Programme, Eggleston H.S., Buendia L., Miwa K., Ngara T. and Tanabe K. (eds).

# Determine GHG Savings From Water Conservation Programs

- W-E model and manual available at:
- http://www.waterandenergyconsulting.com/downloads.html

| Savings Summary | First Year | Lifetime |
|---|---|---|
| **Energy** | | |
| Electricity Saved (kWh) | 0 | 0 |
| Cost of Electricity Saved ($/kWh) | 0.00 | 0.00 |
| Gas Saved (therms) | 0 | 0 |
| Cost of Gas Saved ($/therm) | 0.00 | 0.00 |
| **Water Saved** | | |
| (Millions of Gallons) | 0 | 0 |
| **Green House Gases Reduced** | *(in lbs CO2 equivalent)* | |
| from electricity Saved: | 0 | 0 |
| from gas energy Saved: | 0 | 0 |
| reduced Waste-water: | 0 | 0 |
| Total reduction: | 0 | 0 |

# Chicago Climate Change Prices

| Product | Vintage | Open | High | Low | Close | Change | Volume |
|---|---|---|---|---|---|---|---|
| CFI | 2003 | $2.00 | $2.00 | $2.00 | $2.00 | - | 3,000 |
| CFI | 2004 | $2.00 | $2.00 | $2.00 | $2.00 | - | 1,500 |
| CFI | 2005 | $2.00 | $2.00 | $1.95 | $1.95 | - 0.05 | 4,000 |
| CFI | 2006 | $2.00 | $2.00 | $1.95 | $1.95 | - 0.05 | 53,800 |
| CFI | 2007 | $2.00 | $2.00 | $1.95 | $1.95 | - 0.05 | 11,000 |
| CFI | 2008 | $2.00 | $2.00 | $2.00 | $2.00 | - | 4,500 |
| CFI | 2009 | $2.00 | $2.00 | $2.00 | $2.00 | - | 1,000 |
| CFI | 2010 | $2.00 | $2.00 | $2.00 | $2.00 | - | 1,000 |
| Total Electronically Traded Volume | | | | | | | 79,800 |

# Prepare Yourself

- Stay tuned - we're going down the GHG rabbit hole and things will get "curiouser and curiouser"
- Relook at all your generation options
  - self generation
  - renewables
- Electric costs not going to go down - efficiency becoming more and more important
- Review your water conservation programs
  - utility collaboration
  - sale of carbon credits
- Start looking at system efficiency improvements and additional water conservation programs but from a little bit different perspective - energy savings, and GHG impacts