The Design of California's Energy Future

Presentation of

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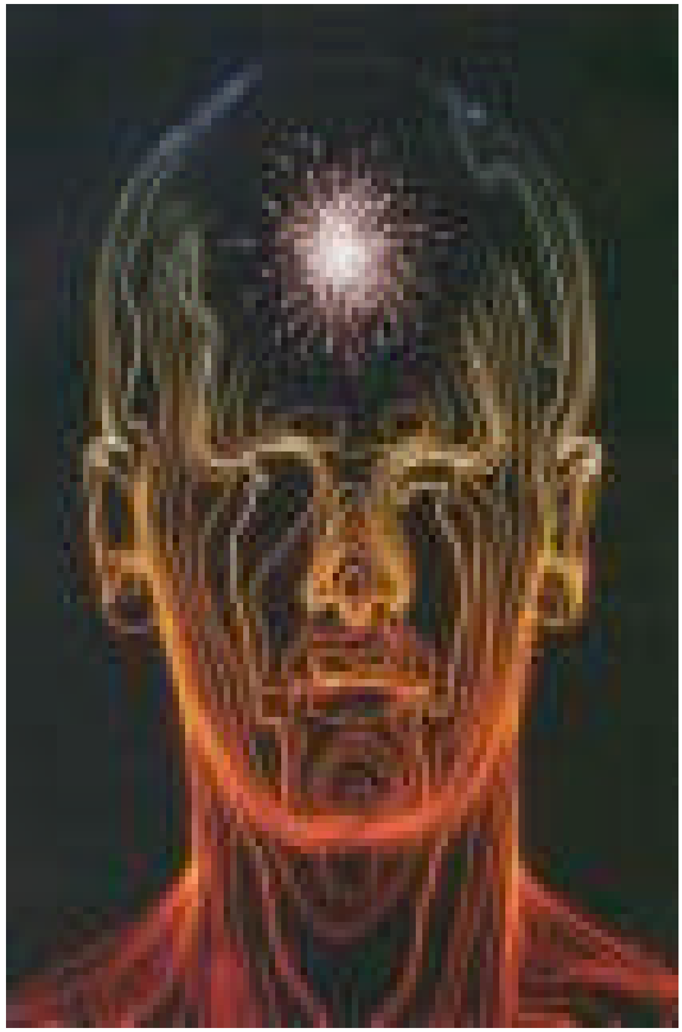
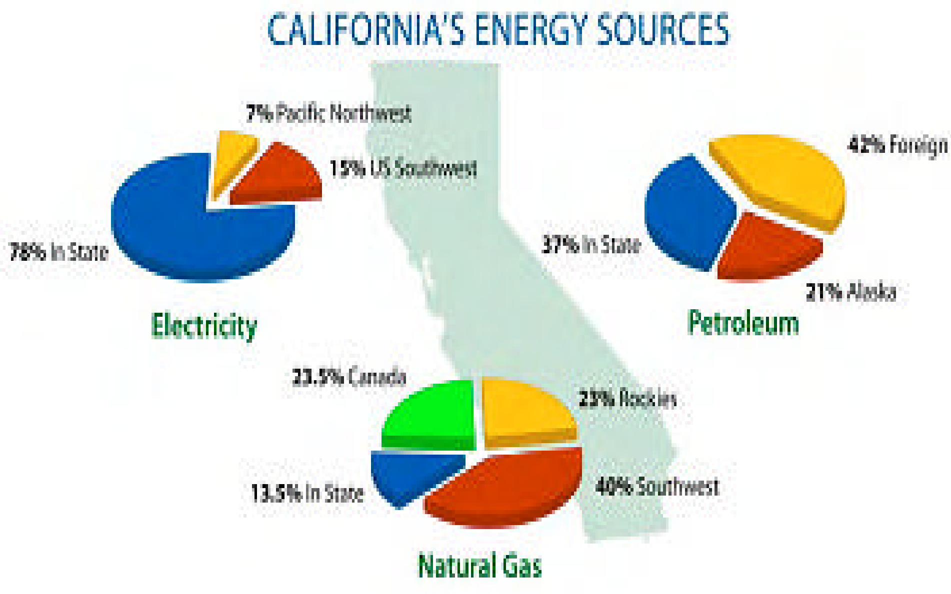


- CEC IEPR
  - demand,
  - supply
  - prices
- CPUC
  - water-energy pilots
  - feed-in water agency renewables tariffs
- ARB/GHG
- Legislation
- Recommendations

The Big Picture

Figure 1-7: California's Big Picture



Source: California Energy Commission 2006

Population Assumptions

Figure 1-4: California's Inland Population Increases

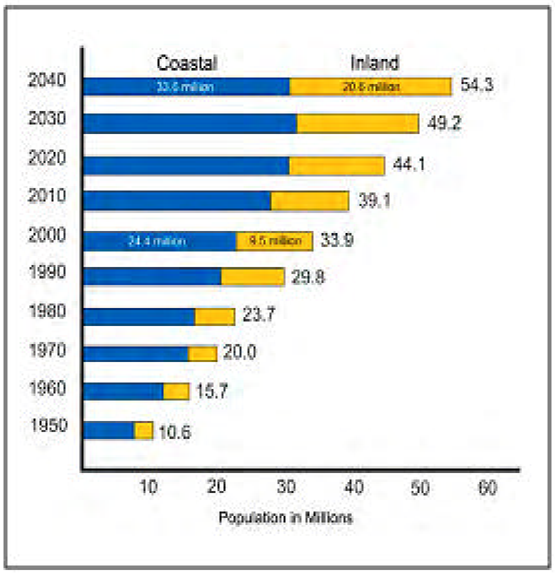
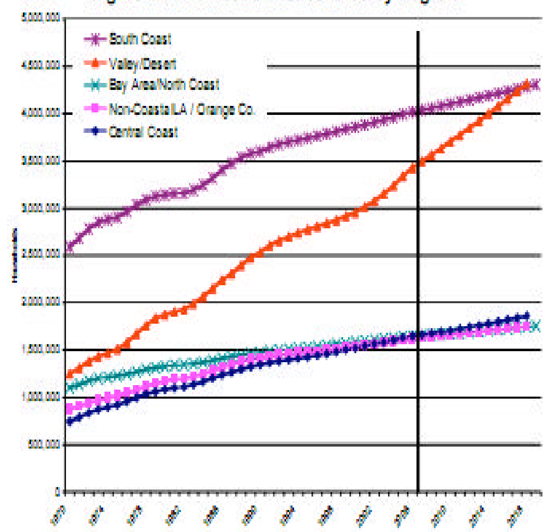
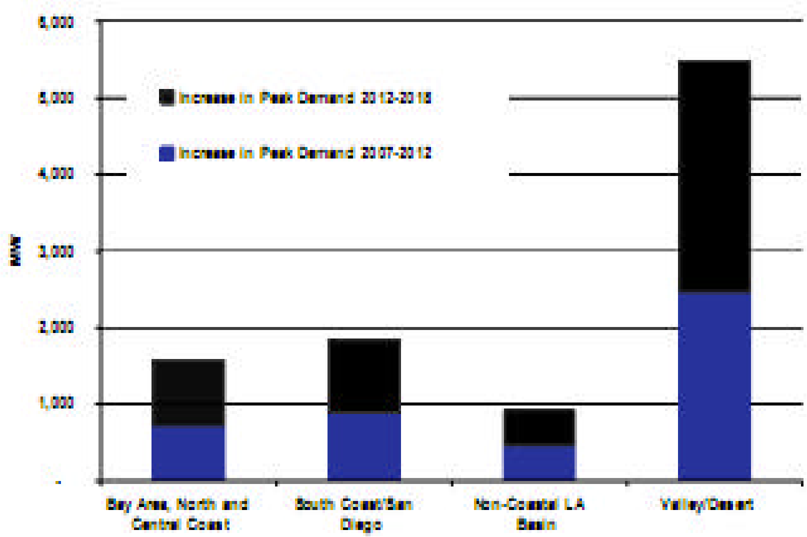


Figure 2-1: Number of Households by Region



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

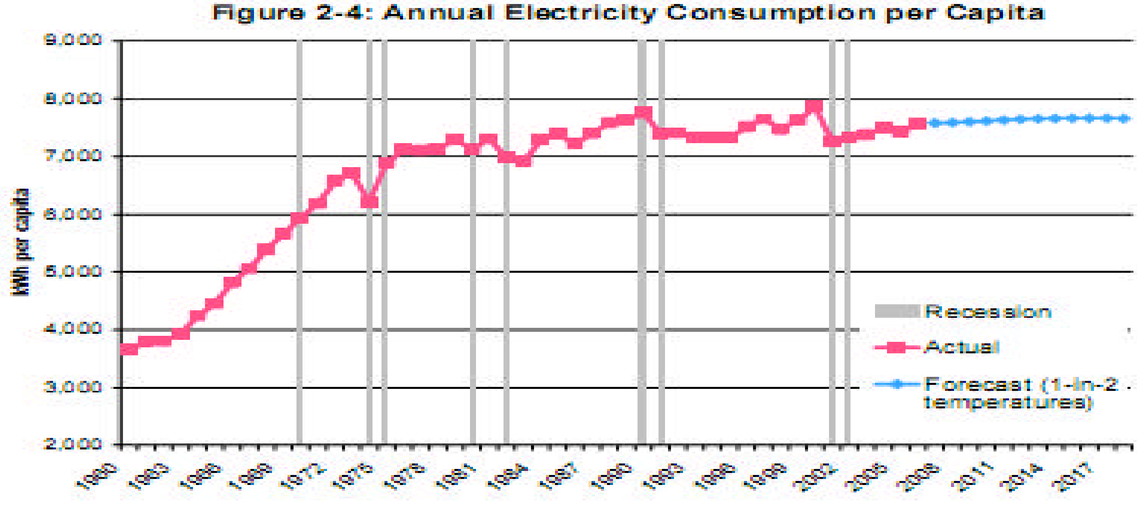
Figure 2-8: Regional Growth in Peak Demand (megawatts)



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

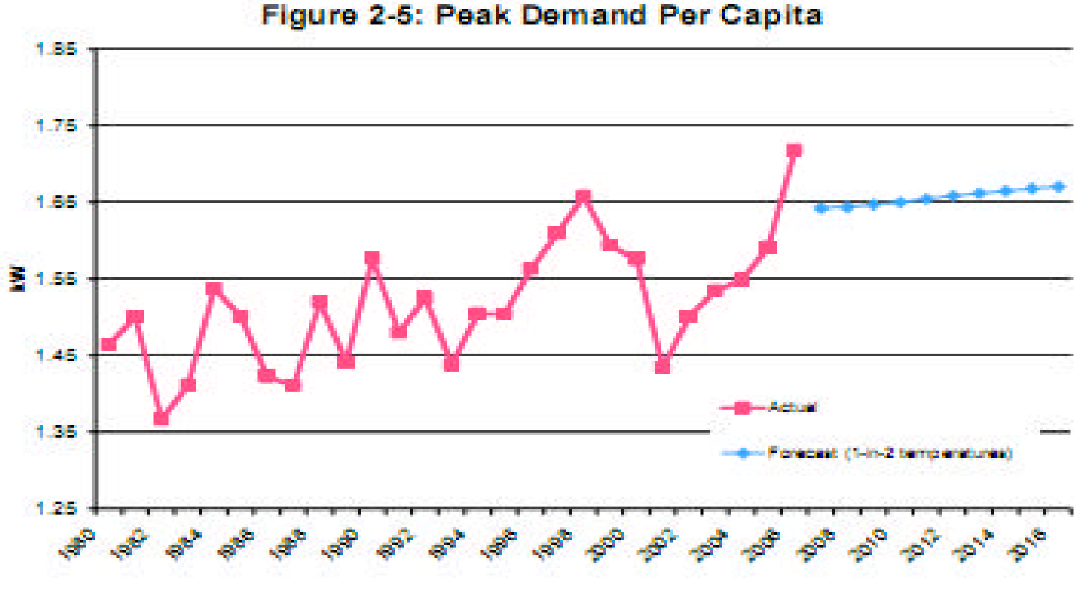
Peak/Electricity Demand Assumptions

Figure 2-4: Annual Electricity Consumption per Capita



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

Figure 2-5: Peak Demand Per Capita



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

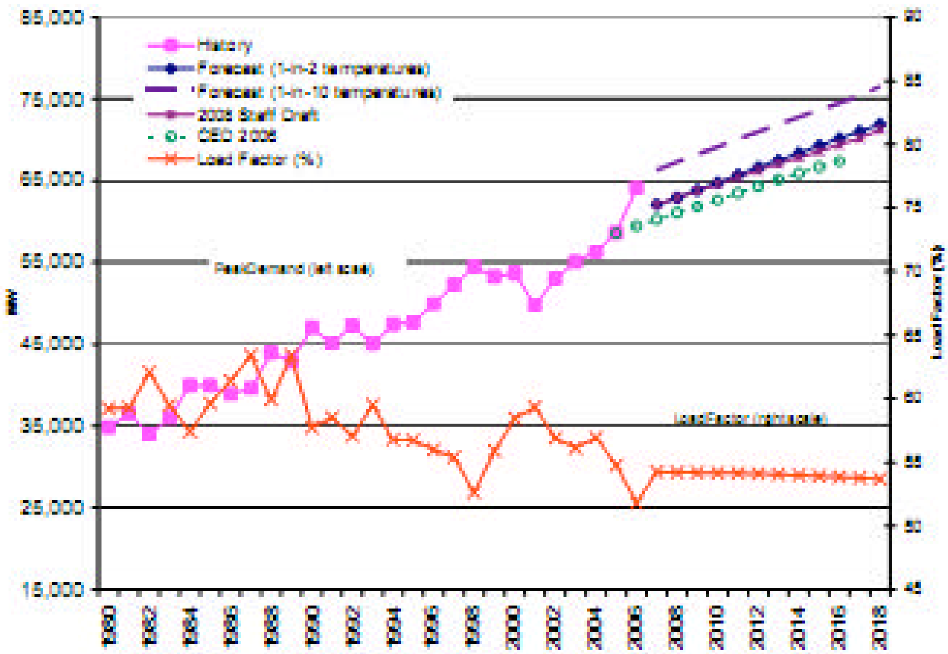
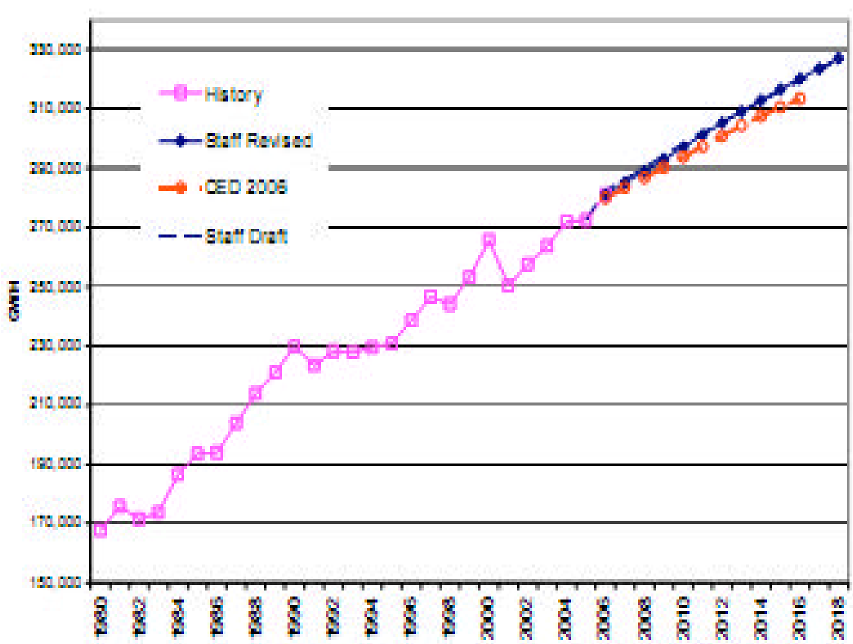


Figure ES-1: Statewide Electricity Consumption



Generation Plants Status

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

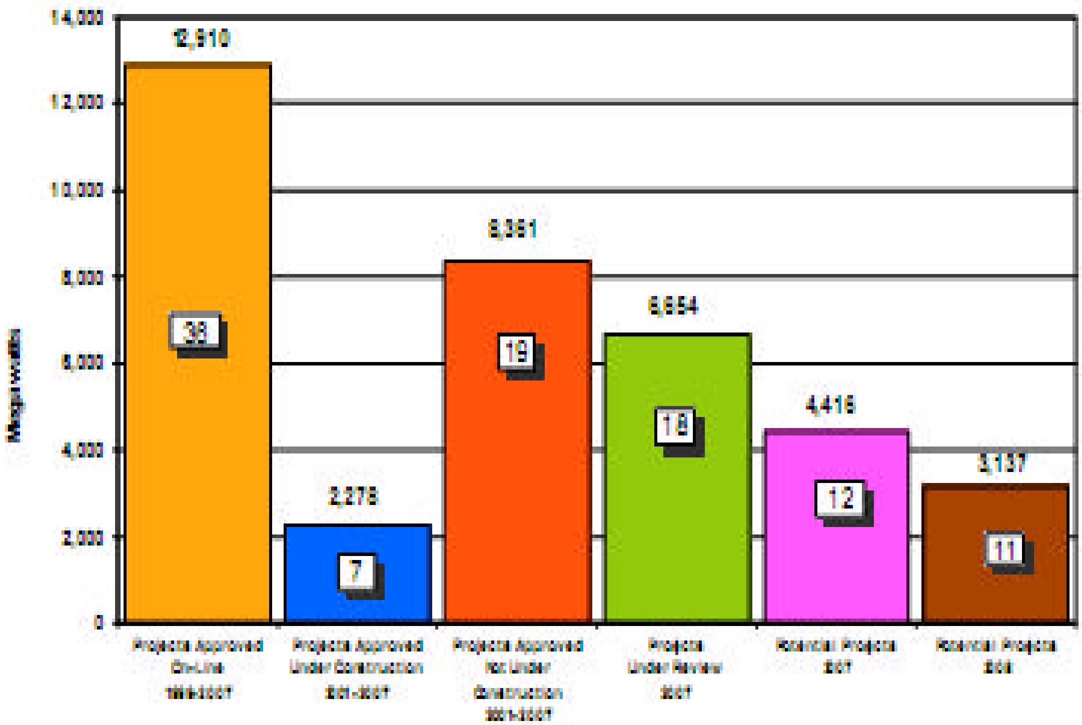


Figure 4-3: Progress Toward California's Renewable Energy Goals

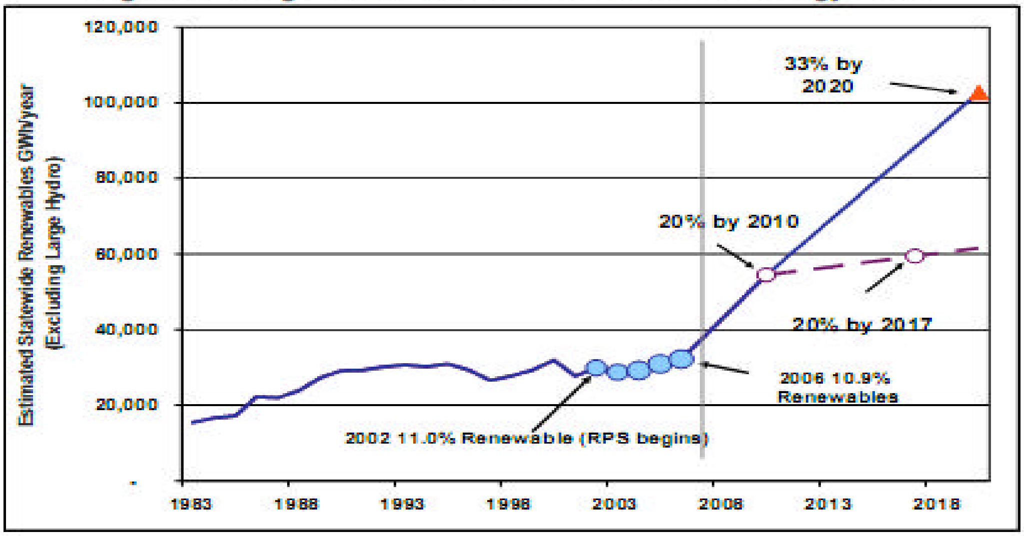
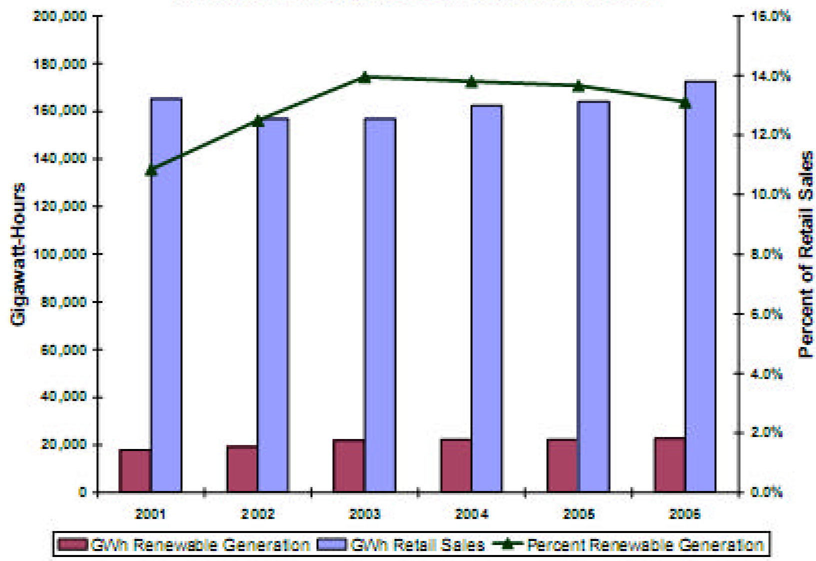
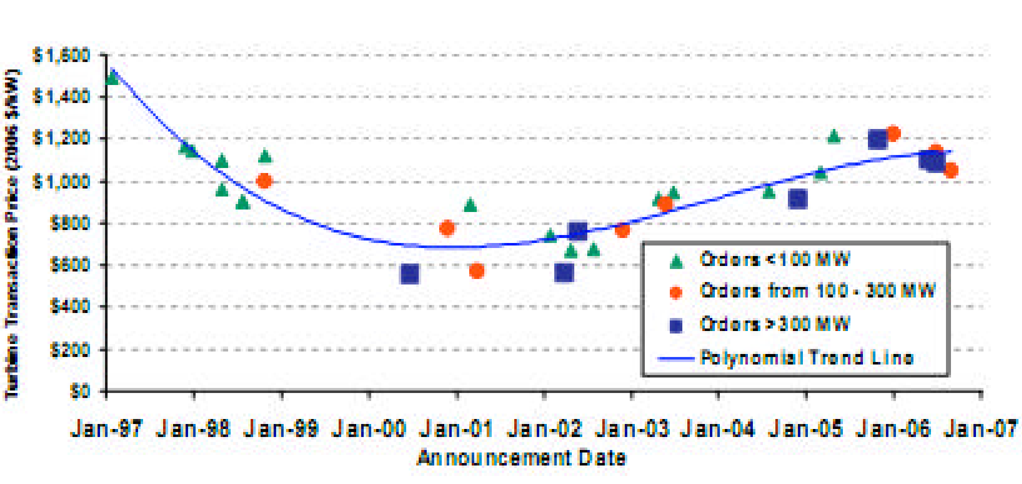


Figure 4-4: Progress of Large Investor-Owned Utilities toward 20 Percent Renewable Energy by 2010 (GWh/year, Percent)



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)

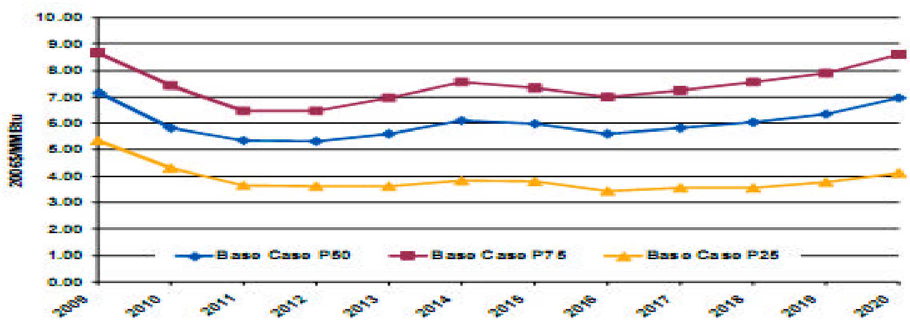


Table 2-4: Reported Natural Gas Prices
(95th Percentile, Nominal $)

	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
	LakeArrowhead WaterConservation	$176,500
	WaterLeakage	$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	CLAWA/EMWD Gas Pump Testing	$436,407
total		$3,482,907
Evaluations*	Commercial and Industrial Pilot Programs	
	I. Commercial programs (PG&E)	$123,000
	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)	$64,000
	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)	$20,000
	Statewide/Regional Water-Energy Relationship	$425,000
	WaterAgency /Function Component	$850,000
total		$1,770,300
Total	total evaluation and studies (EM&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 2% of the approved individual program budgets.

Water Agencies Renewable Generation Tariff

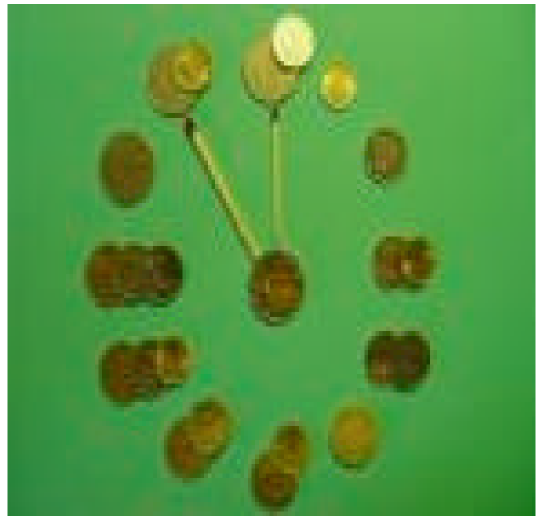
- AB 1969 implementation
- SCE's Advice Letter pulled due to protests - should look like PG&E's
- PG&E's approved
  - Tariff E-PWF - power purchase arrangement
  - first 104.63 MW
  - PG&E does the scheduling
  - standard interconnection requirements
  - full buy sell or excess sale
  - 10, 15, or 20 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-Year**
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

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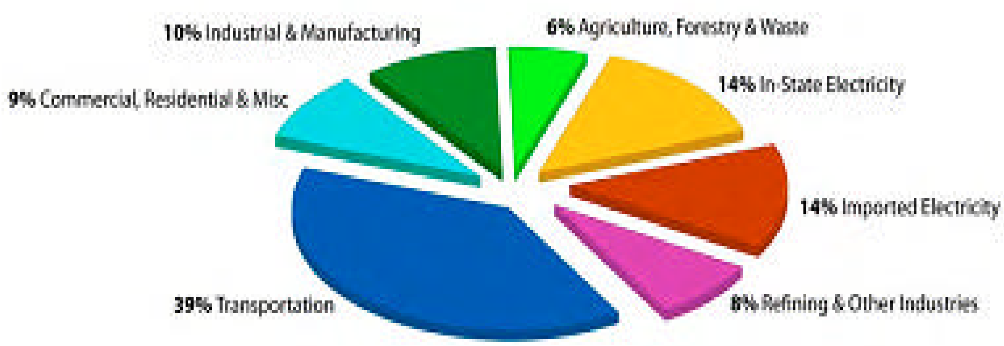
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
4 - WASTE	7.41	7.15	7.42	7.43	7.46	7.01	6.90	6.86	7.07	7.05	6.82	6.91	6.79	6.87	6.88
4A - Solid Waste Disposal	6.58	6.29	6.54	6.54	6.55	6.10	5.98	5.92	6.12	6.06	5.82	5.89	5.78	5.83	5.83
4A1 - Managed Waste Disposal Sites	6.58	6.29	6.54	6.54	6.55	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

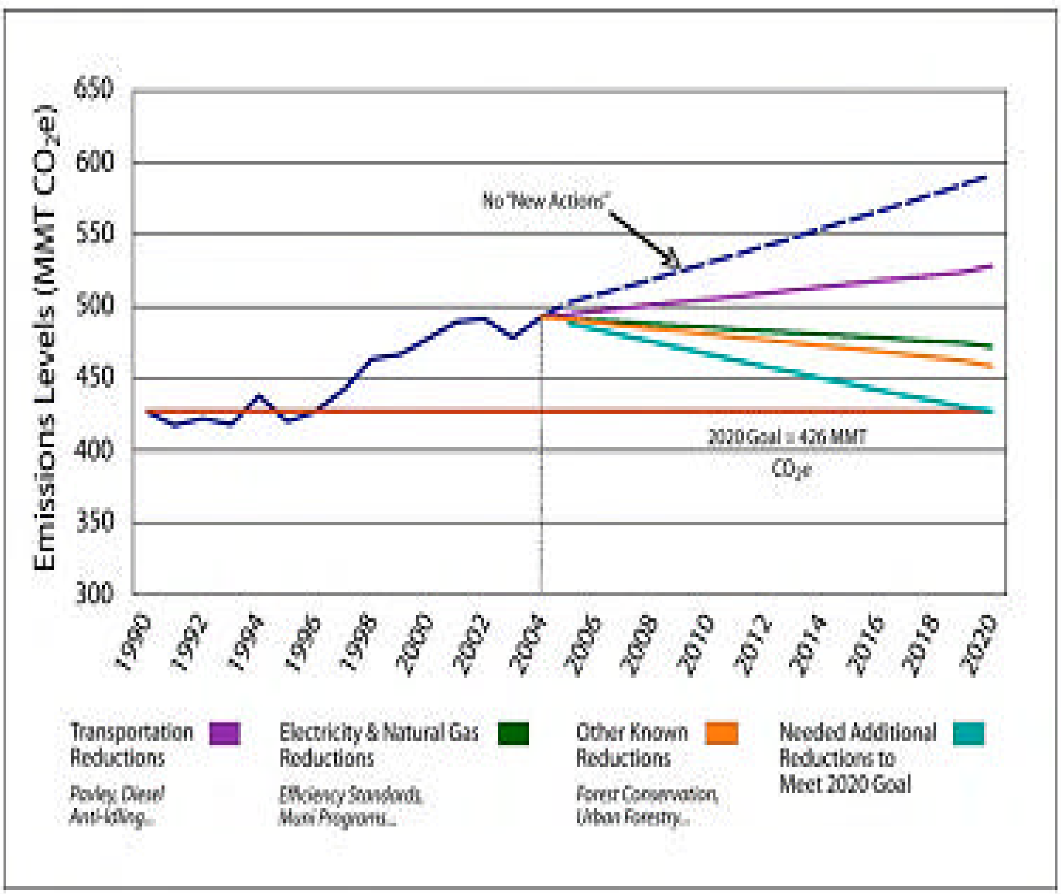
Figure 1-3: California Greenhouse Gas Emissions in 2004



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(e)(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