Focus on California Results

2011 IEPR and Electricity and Natural Gas Joint Committee Workshop

California Energy Commission

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Overview

- Describe organizing framework, questions, and key drivers
- Describe the two cases designed to move California gas demand
  - High California Gas Demand Case
  - Low California Gas Demand Case
- Examine California-focused World Gas Trade Model and post-processing results for all cases, including the “national” cases designed to move natural gas market prices

http://www.energy.ca.gov/2011_energypolicy/documents/index.html#09272011

Organizing Framework

- Natural gas and related electricity and other energy markets characterized by high complexity, many alternative options for action, and deep uncertainty
- Infeasible to make accurate predictions of long-term market outcomes
- Model results are conditional estimates
- Modeled cases increase understanding of the effects of uncertainties in key drivers
- Goal is more robust policy decisions that require some assumption be made about future gas markets

Organizing Questions

- What potential vulnerabilities might California face in the future?
  - From high gas prices
  - From high gas demand
- What potential opportunities might California enjoy in the future?
  - From low gas prices
  - From low gas demand

Drivers of Electric Generation Gas Demand

- Economic conditions
- Complex and interacting energy and environmental policies "aimed" at electricity demand or the resource mix or efficiency of generation
  - Energy efficiency, renewable generation (RPS, DG), combined heat and power act to decrease EG gas demand
  - Transportation electrification, shutdowns of coal or nuclear powered generation act to increase EG gas demand

High California Gas Demand Case

- Increase annual average growth rate of overall California electricity demand by about 0.25 percent to 1.44% (to match the growth rate in High Demand Case of the adopted *2009 IEPR* demand forecast).
- Eliminate more than 34,000 GWh of California-located nuclear generation by 2025 (neither SONGS nor Diablo Canyon relicensed).
- Slow California RPS compliance (target grows only 1 percent per year through 2029, when 33 percent is reached).
- Double the amount of residential and commercial sector electric vehicle charging embedded in the California Energy Commission's adopted *2009 IEPR* demand forecast, adding 2,400 GWh by 2020 and 4,500 GWh by 2030.
- Add 200 million therms of natural gas transportation demand by 2020 and 400 million therms by 2030 (40-60 million therms currently exist).

Low California Gas Demand Case

- Slow annual average growth rate of overall California electricity demand by 0.15 percent to 1.04% (to match the Low Demand Case of the adopted *2009 IEPR* demand forecast).
- Continue increasing California procurement of RPS-eligible renewable generation by 1 percent of retail sales per year between 2021 (when its 34 percent) and 2027, leveling off at 40 percent in 2027 and beyond.
- Add additional non-RPS-eligible distributed renewable generation, about 6,000 MW by 2030, generating about 8,500 GWh (16 percent annual capacity factor).

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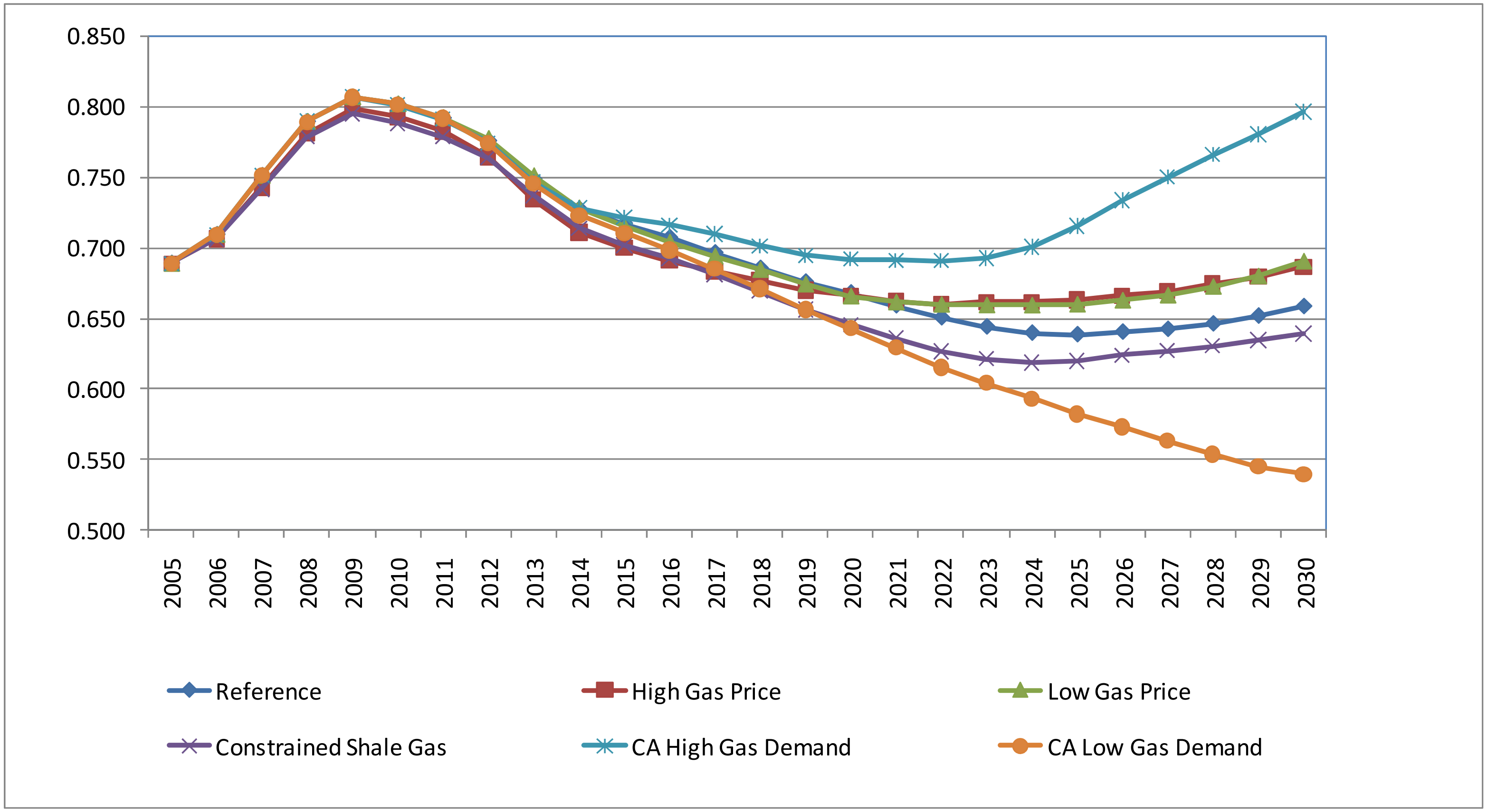
Highlights of California Electric Generation-Related Input Assumptions for Cases Focused on California Gas Demand Impacts

	Reference	High CA Gas Demand	Low CA Gas Demand
		2017	
Total CA Electric Generation (GWh/yr)	223,664	224,925	222,181
Nuclear Share of CA Gen (% of Total)	15.1%	15.0%	15.1%
Hydroelectric Share	12.2%	12.2%	12.3%
Renewable Share	25.1%	21.4%	27.6%
Fossil Share	47.6%	51.5%	45.0%
CA Gas Demand for Electric Generation (Tcf/yr)	0.6702	0.7132	0.6375
		2022	
Total CA Electric Generation (GWh/yr)	238,058	242,021	232,741
Nuclear Share of CA Gen (% of Total)	14.5%	11.3%	14.5%
Hydroelectric Share	11.5%	11.3%	11.8%
Renewable Share	29.4%	25.8%	35.0%
Fossil Share	44.5%	51.6%	38.7%
CA Gas Demand for Electric Generation (Tcf/yr)	0.6448	0.7237	0.5691
		2030	
Total CA Electric Generation (GWh/yr)	259,909	265,096	251,119
Nuclear Share of CA Gen (% of Total)	13.7%	0.0%	13.7%
Hydroelectric Share	10.5%	10.3%	10.9%
Renewable Share	28.7%	33.0%	40.0%
Fossil Share	47.1%	56.7%	35.4%
CA Gas Demand for Electric Generation (Tcf/yr)	0.7467	0.9295	0.5473

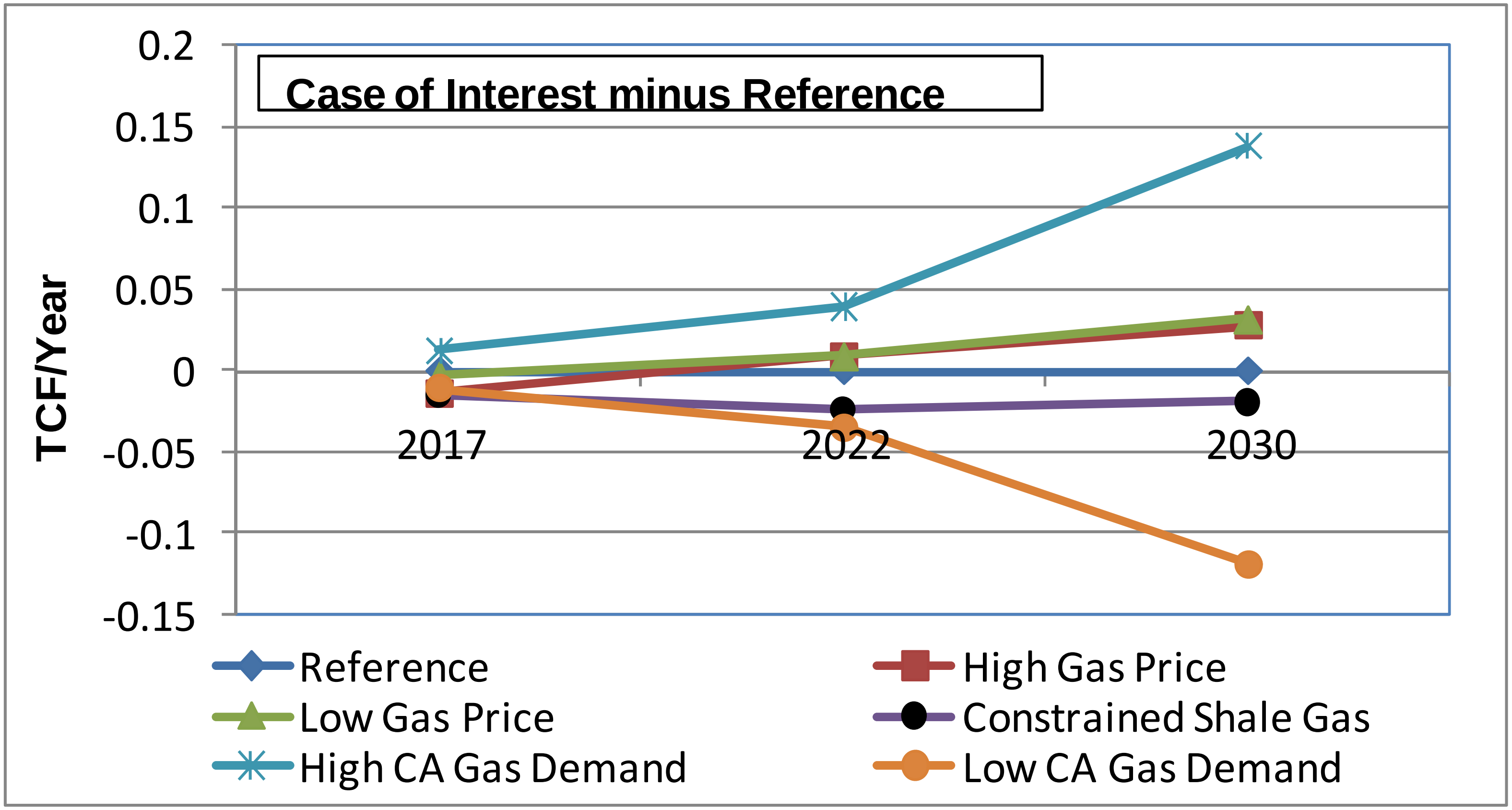
California Power Generation Gas Demand, All Cases, Tcf/Year



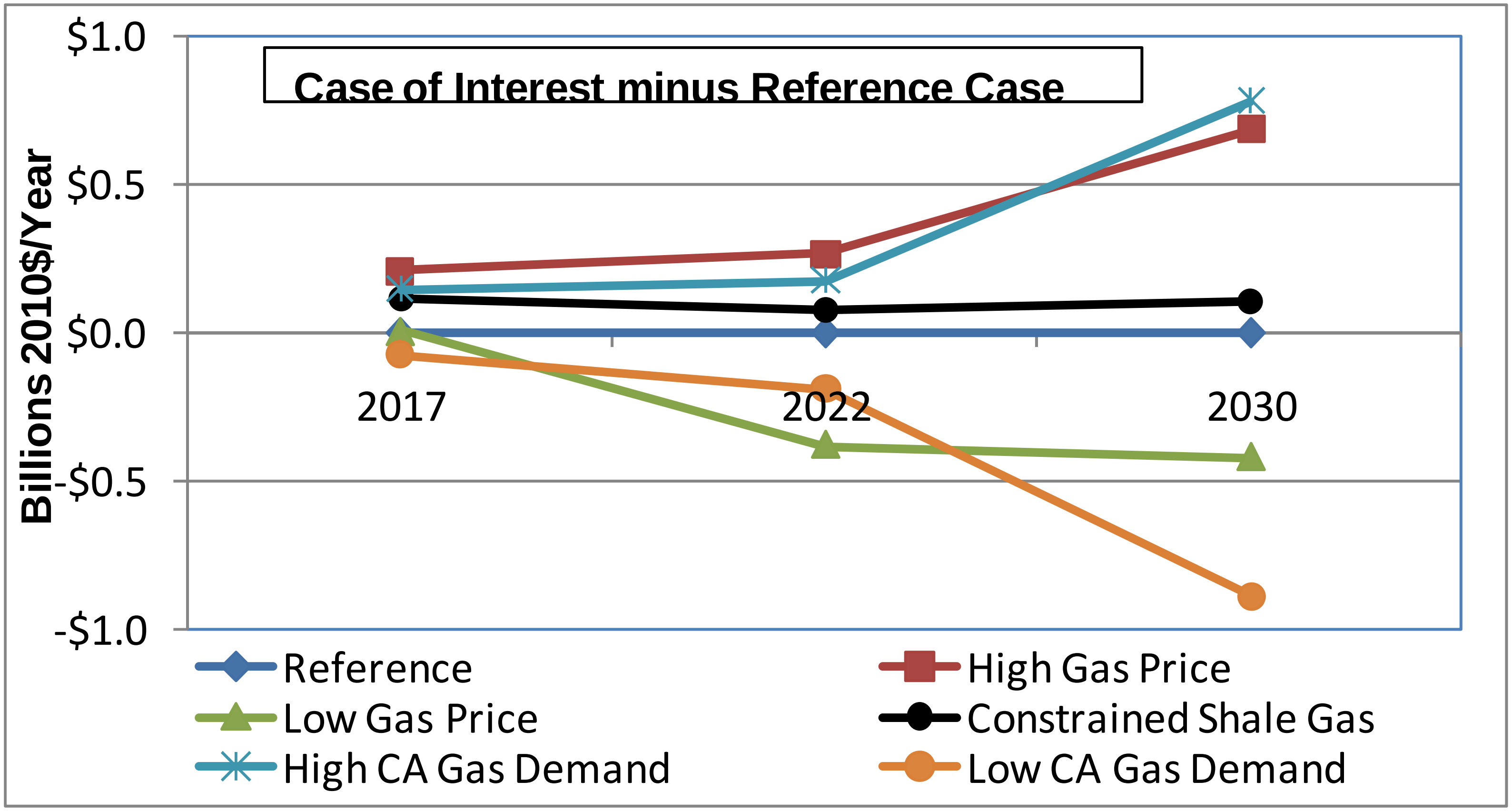
Rough Estimates of California Power Generation Sector Gas Demand, Gas Costs, Combustion CO_2 Emissions, and Minimum CO_2 Allowance Costs by Case

Selected California Power Generation Sector Results	Reference	High Gas Price	Low Gas Price	Constrained Shale Gas	High CA Gas Demand	Low CA Gas Demand
	2017					
Gas Demand (Bcf/Yr)	697	683	694	681	710	685
Combustion CO2e Emissions (Millions Tonnes CO2/Yr)	38.5	37.8	38.4	37.7	39.3	37.9
Gas Costs (Millions 2010 $/Yr)	$4,285	$4,498	$4,293	$4,401	$4,432	$4,208
CO2e Allowance Costs (Millions 2010 $/Yr)	$465	$456	$464	$455	$474	$458
	2022					
Gas Demand (Tcf/yr)	651	660	660	627	691	616
Combustion CO2e Emissions (Millions Tonnes CO2/Yr)	36.0	36.5	36.5	34.7	38.2	34.1
Gas Costs (Millions 2010 $/Yr)	$4,310	$4,577	$3,933	$4,390	$4,484	$4,121
CO2e Allowance Costs (Millions 2010 $/Yr)	$555	$563	$563	$535	$589	$525
	2030					
Gas Demand (Tcf/yr)	659	687	691	639	797	540
Combustion CO2e Emissions (Millions Tonnes CO2/Yr)	36.4	38.0	38.2	35.4	44.1	29.9
Gas Costs (Millions 2010 $/Yr)	$4,620	$5,303	$4,200	$4,726	$5,399	$3,730
CO2e Allowance Costs (Millions 2010 $/Yr)	$829	$865	$870	$805	$1,003	$680

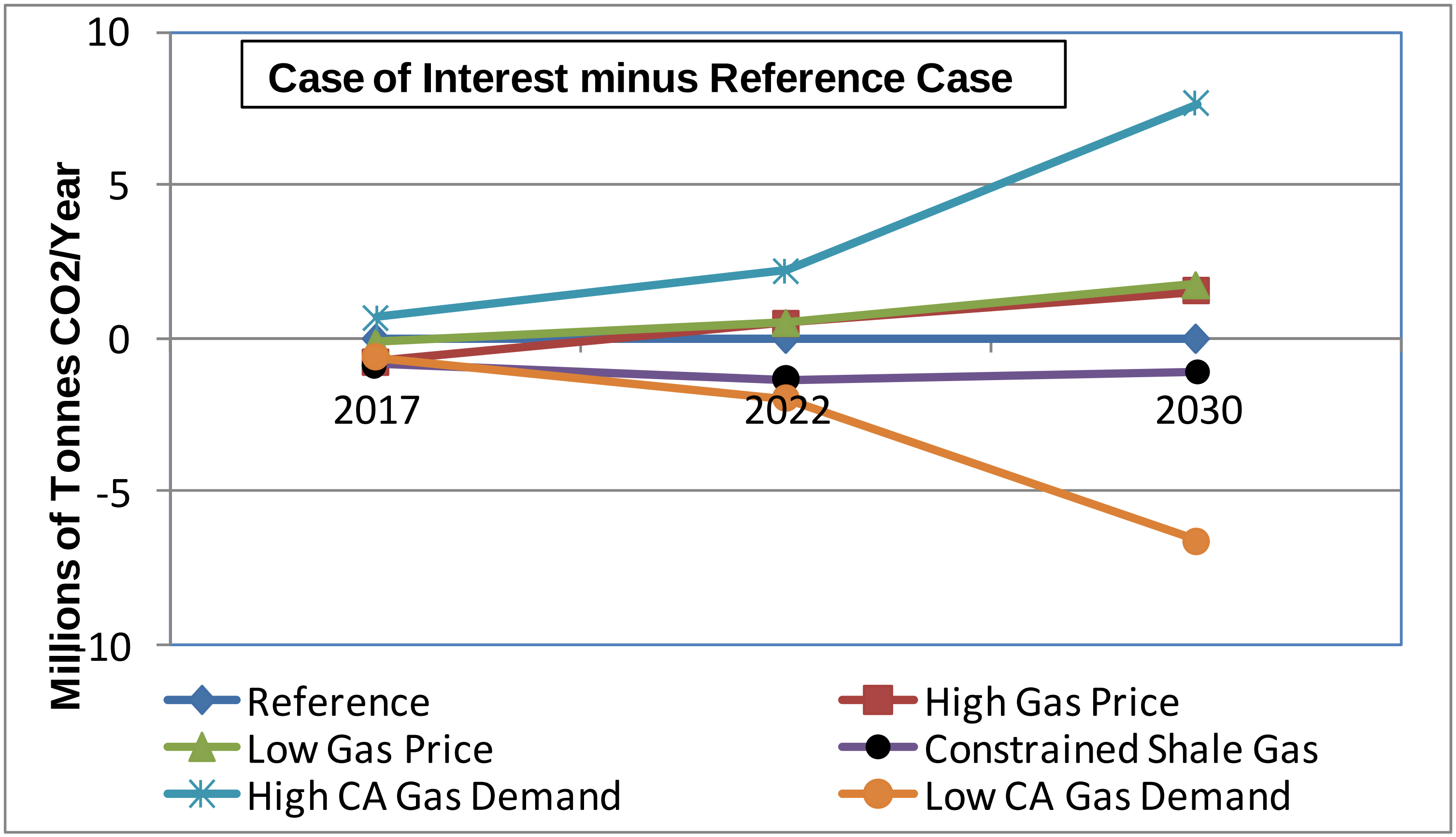
Differences in California Power Generation Annual Gas Demand Across All Cases



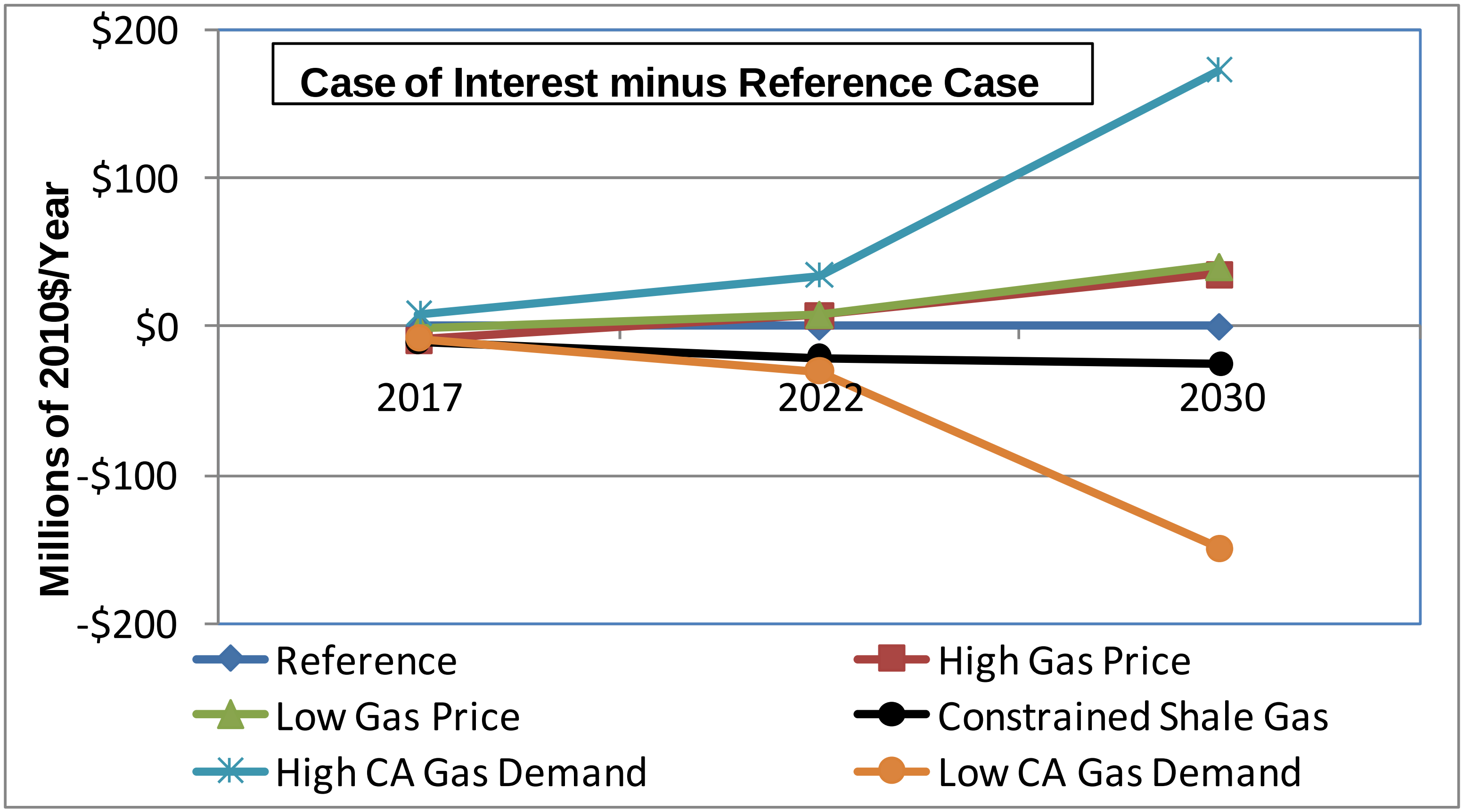
Differences in Estimated California Power Generation Annual Gas Costs Across All Cases



Differences in Estimated California Power Generation Annual CO_2 Emissions From Combustion Across All Cases



Differences in Estimated California Power Generation Annual Emission Allowance Costs Across All Cases



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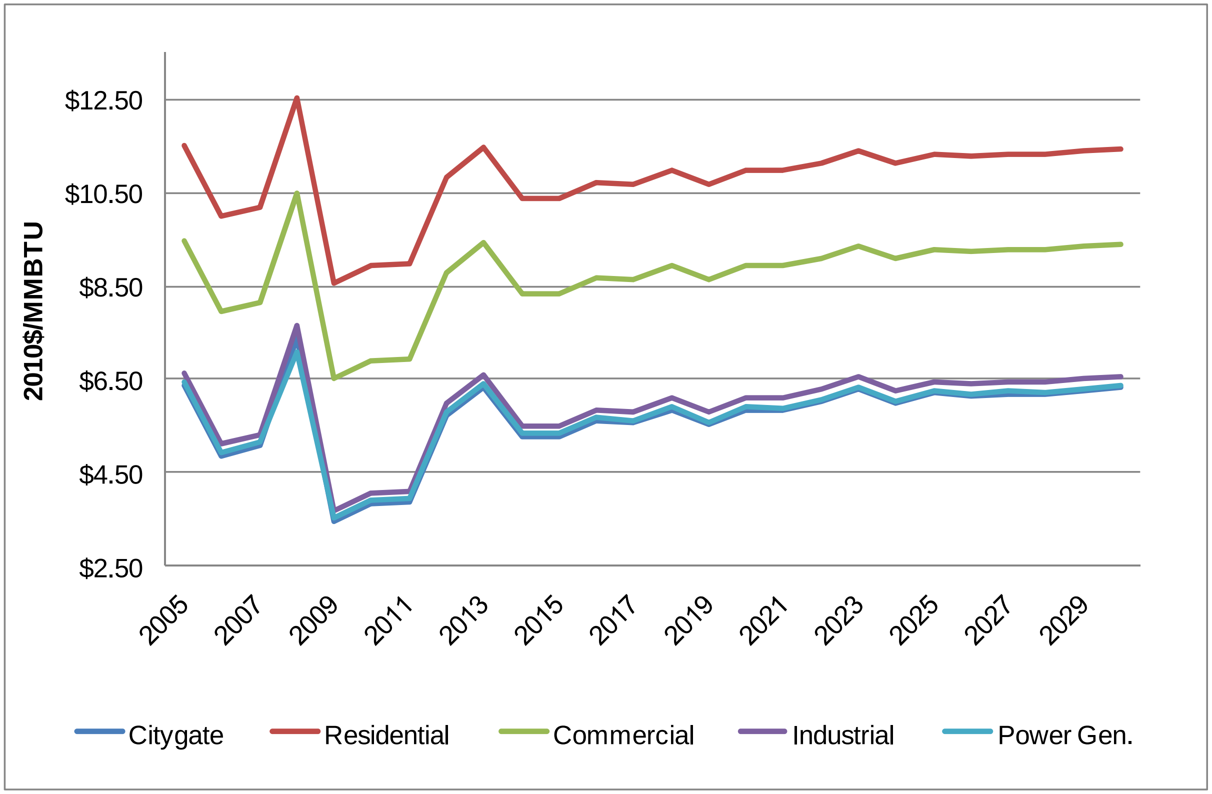
End-Use Gas Prices



End-User Price Uncertainty

- Transportation and distribution cost components of staff's end-user prices held constant over time
- Factors contributing to uncertainty about future T & D costs
  – Capital investments for pipeline inspection, repair or replacement
  – Continuation of the Public Purpose Program surcharge
  – Recovery of costs for CO2 allowances