



# Assumptions for 2009 Resource Plan Analysis

Public Version  
June 29, 2009

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## Introduction

- This document presents the key assumptions used in CPS Energy's Spring 2009 Resource Plan Analysis
- This document is provided as an overview, covering only the main assumptions



## Resource Plan Analysis Overview

- The goal of analysis is to compare various base load resource options for meeting future demand
- Two analysis perspectives:
  - “Base case” – All assumptions occur as projected
  - “Risk based” – Takes into account uncertainty and probable ranges of values of assumptions
- Analysis excludes power plant construction beyond 2017
  - Isolates the analysis on the next generating unit
  - Energy and capacity is purchased from the market to serve native load and to maintain 12.5% reserve margin in all scenarios on an as needed basis



## 2009 Scenarios

- Busbar cost (or annualized total cost of electricity) analysis was accomplished for seven scenarios:
  - Nuclear
  - Natural Gas Combined Cycle (NGCC)
  - Supercritical Pulverized Coal (SCPC) with CCS
  - Integrated Gasification Combined Cycle (IGCC) with CCS
  - Solar Thermal
  - Wind
  - Market Purchase
- Allows for comparison of the annualized total cost of electricity on an equal basis
- Nuclear, NGCC, and Market Purchase scenarios were then analyzed in detail

Note: CCS = carbon capture & storage



## 2009 Scenarios (cont.)

- Scenarios analyzed in detail:
  - Nuclear – 40% ownership in the South Texas Project nuclear units 3 & 4 that includes power purchase agreements (PPA) with third parties
  - NGCC – Development of a natural gas-fired combined cycle unit with no ownership in STP 34
  - Market Purchase – No base load units built after 2010: reliance on market purchases
- 40% STP 34 PPA Ownership and Power Purchase Structure:
  - Initially, 25% is for CPS Energy native load and 15% is for power purchase agreements
  - Upon PPA expiration, nuclear capacity is made available for CPS Energy native load as shown below:

Year	% Share	STP 34 MW Added	STP 34 MW Total	Comment
2016/2017	25%	675	675	Initial % for CPS
2032	5%	135	810	PPA #1 expires
2037	5%	135	945	PPA #2 expires
2042	5%	135	1,080	PPA #3 expires

- Nuclear on-line 2016 to 2017, NGCC on-line 2017

Note: The Market Purchase scenario was included for financial comparison only.



## Peak Demand Forecast (MW)



Note: Save for Tomorrow Energy Plan (STEP) is included.



## Native Load Forecast (MWh)

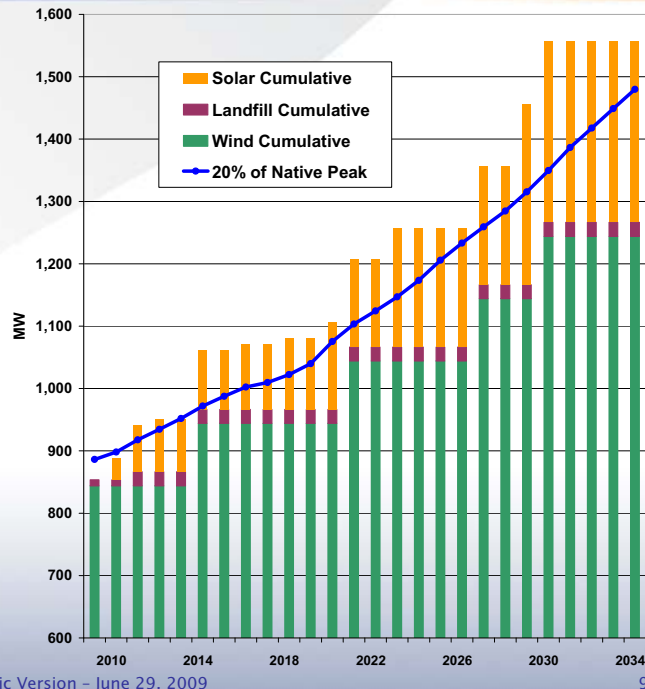


Note: Save for Tomorrow Energy Plan (STEP) is included.



## Renewable Plan

- 2008 Renewable Goals:
  - Renewable capacity equal to 20% of native load peak demand by 2020
  - 100 MW solar capacity by 2020
- Planned renewable capacities in 2020:
  - Wind 944 MW
  - Landfill 22 MW
  - Solar 115 MW
  - Total 1,081 MW



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## CO<sub>2</sub> Assumptions

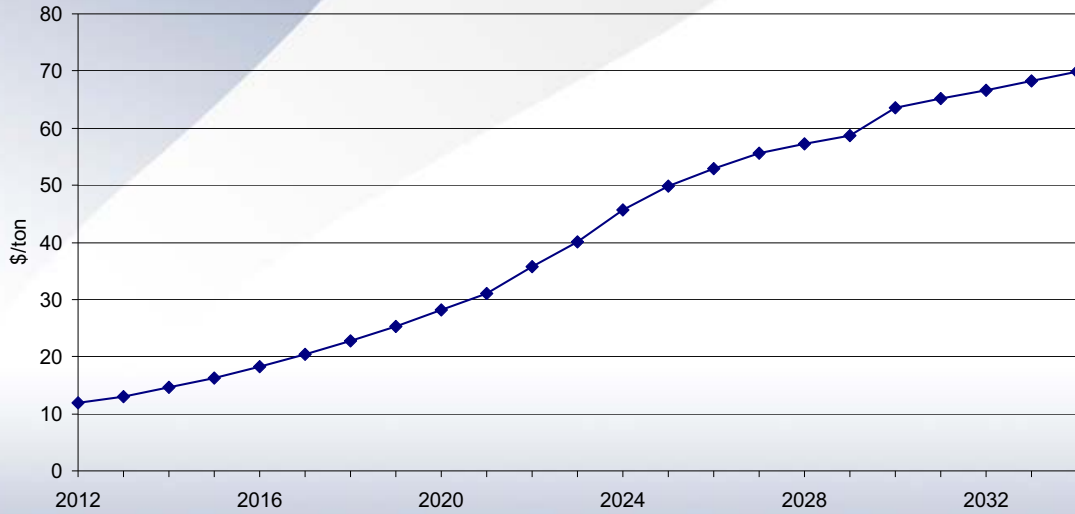
- Projections developed from an econometric model
- Assumes economy-wide application
- CO<sub>2</sub> allowance allocation distribution based on proposed Lieberman-Warner legislation
  - Latest proposal, Waxman-Markey, still being debated at time of analysis

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## CO<sub>2</sub> Emissions Cost Forecast

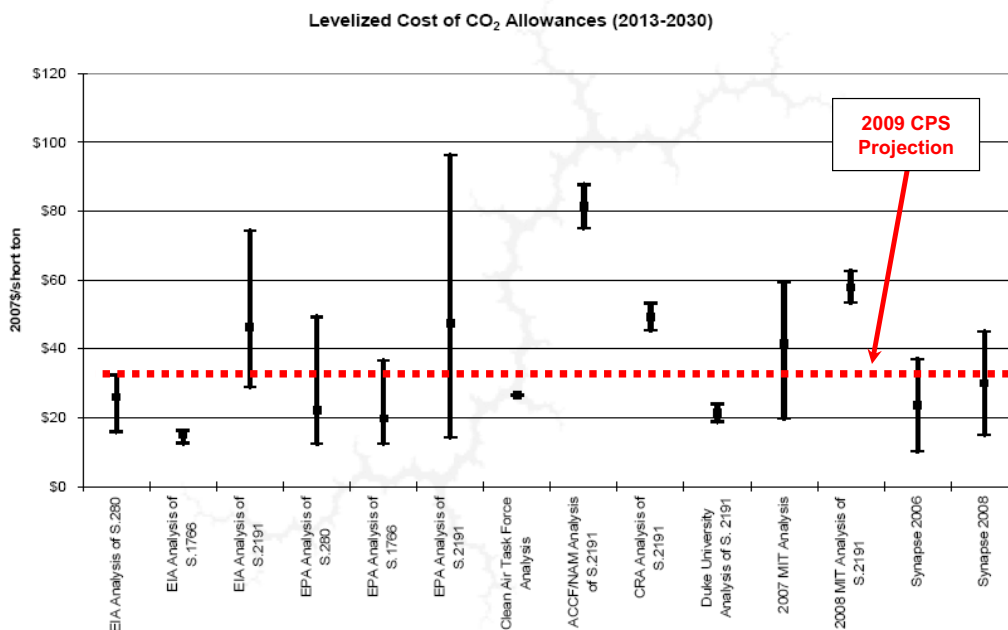


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## Comparison of Past Legislative Proposals on Green House Gases (GHG)



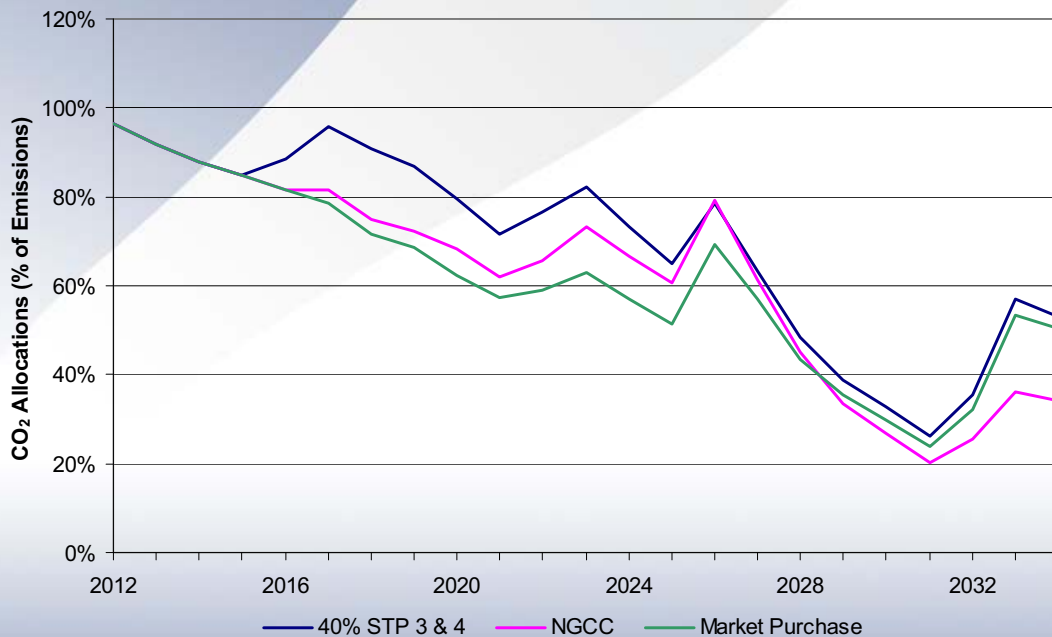
Ref: Synapse Energy Economics, inc.; NARUC presentation

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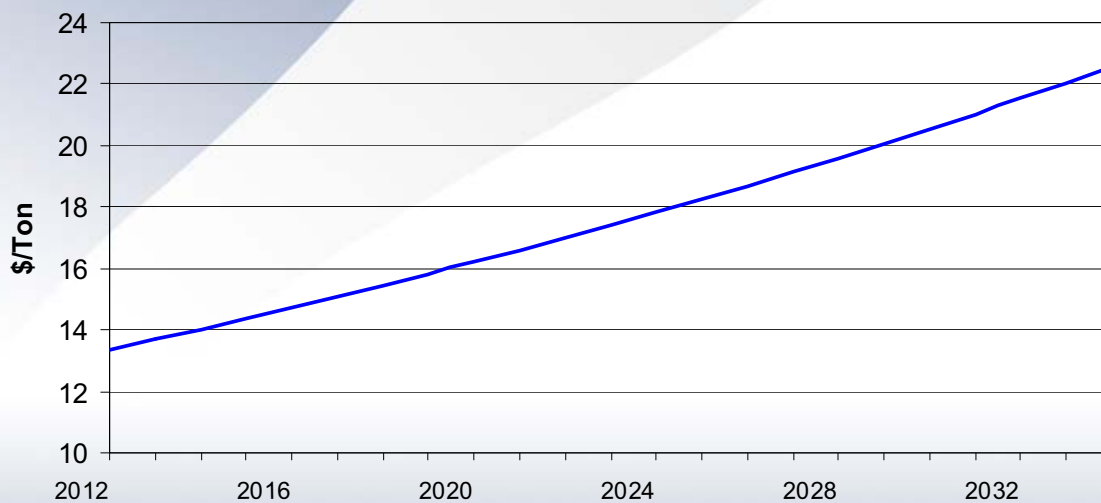
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## CO<sub>2</sub> Allowance Projections



## CO<sub>2</sub> Transportation & Storage Cost Forecast





## CO<sub>2</sub> Assumption Risks

- Projections are based on a plausible scenario to reduce CO<sub>2</sub> emissions, but assumes some relaxation from recent legislative proposals
- There are strong political pressures for both more and less stringent legislation
- Removal technology costs are based on current processes in initial field trials
- Sequestration still faces significant hurdles
  - Unclear regulatory environment
  - Geologic data and technology issues
  - Liability risks associated with CO<sub>2</sub> transportation & long-term storage are not quantified

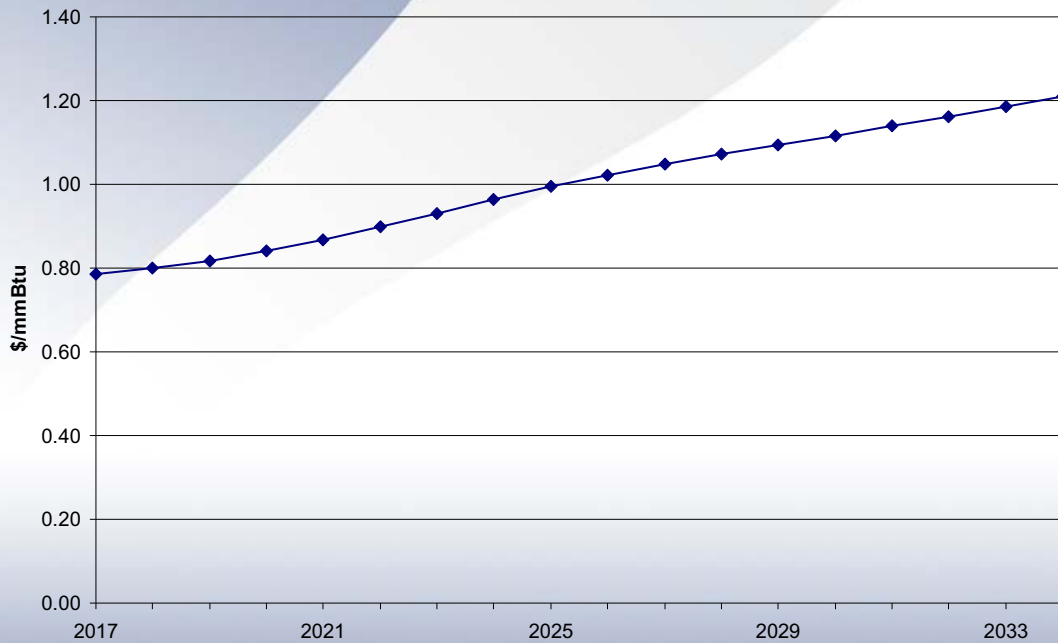


## Fuel Assumptions

- Prices reflect existing contracts and future markets
- Market analysis based on outlook that considers moderately restrictive carbon legislation beginning 2012 and global demand/supply balances (where applicable)
  - Long-term fuel prices have significant impact on study results



## Nuclear Fuel Price Forecast

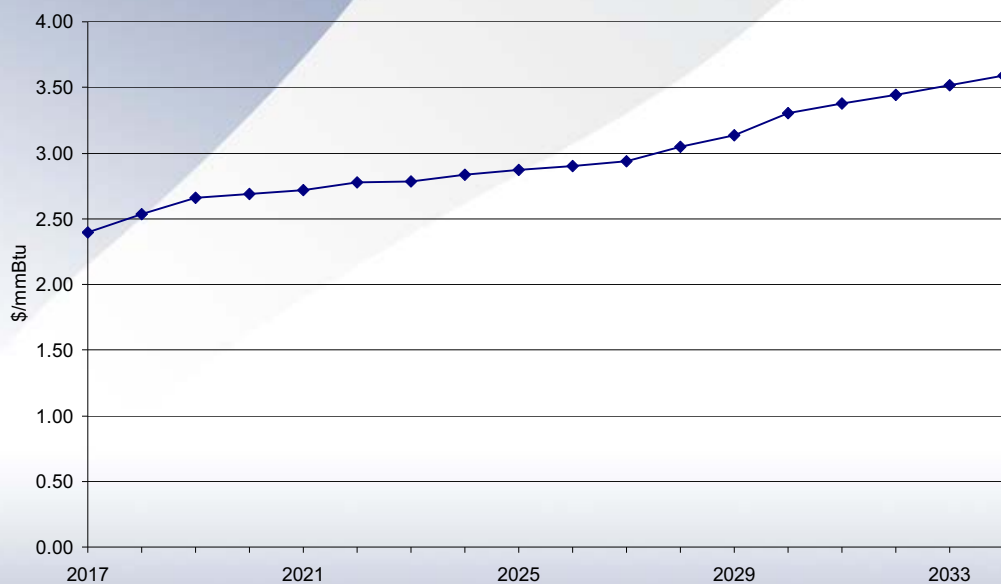


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## Coal Price Forecast



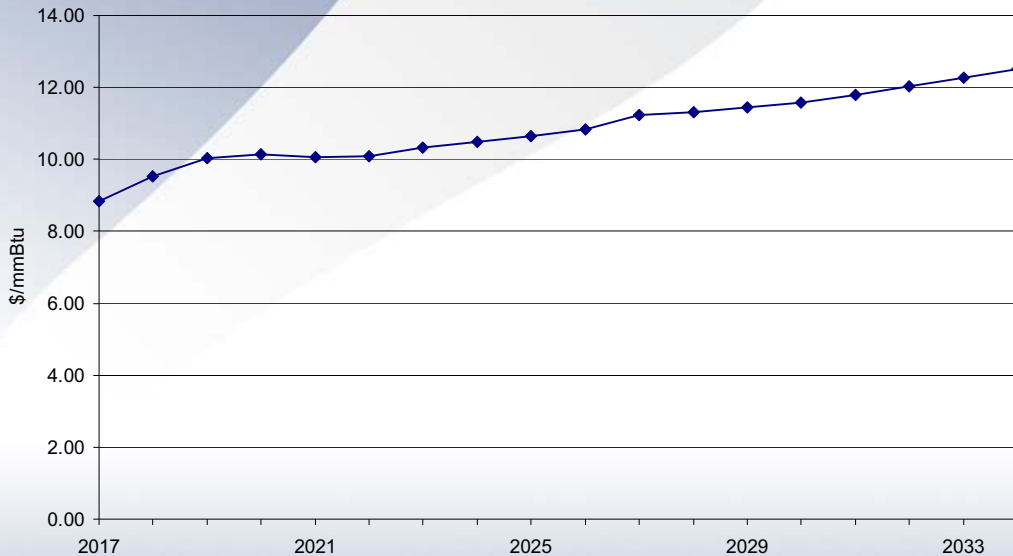
Price of Powder River Basin (PRB) coal delivered to San Antonio, TX

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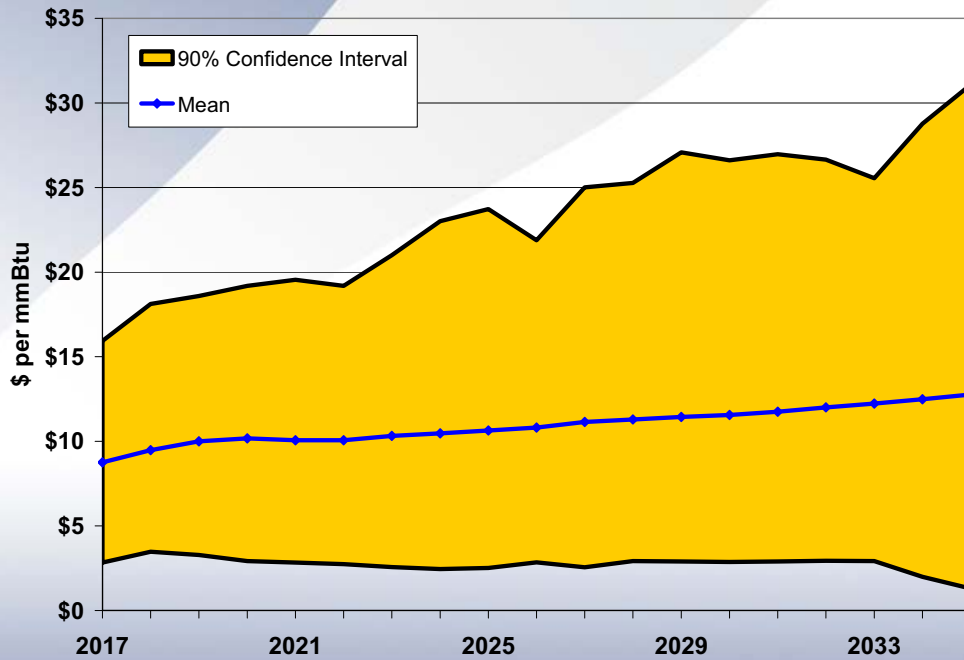
## Natural Gas Price Forecast



Price of natural gas delivered to San Antonio, TX

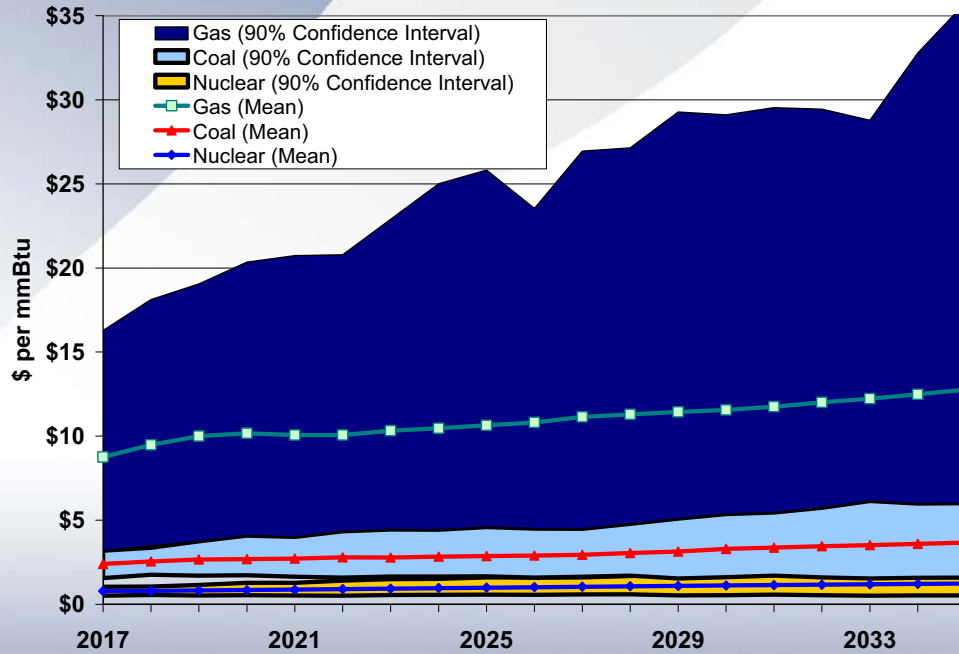


## Natural Gas Price Uncertainty





## Comparison of Fuel Projections



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## Financial Assumptions

Debt (%) of Total Equity Target	58-65%
Interest on Fixed Rate Debt (Current Credit Ratings)	5.5%
Increase to Debt Cost of Ratings Downgrade (within AA)	10-15 Basis Points
Increase to Debt Cost of Ratings Downgrade (AA to A)	100 Basis Points
Interest on Variable Rate Debt (Years 1-5)	1.5 - 3.5%
Interest on Variable Rate Debt (>5 Years)	4.0%
Equity Rate of Return Target (%)	10-13%
Current Weighted Average Long-term Debt Cost	4.8%
Discount Rate (Weighted Average Cost of Capital) (%)	8.1%
Variable Rate Debt % of Total Debt Target	15-25%
Debt Financing Term (years) - Non-nuclear assets	20-30
Debt Financing Term (years) - Nuclear assets	40
Interest During Construction Rate (%)	4.25 - 5.5%

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## Financial Assumptions (cont.)

Investment Income Rate (Years 1-5)	0.8 - 2.5%
Investment Income Rate (> 5 Years)	3.0%
Priority Debt Service Coverage Ratio Target (Current Credit Ratings)	2.5
Debt Service Coverage after Owner Payment Target	1.5
Initial R&R Acct Minimum Fund Balance	\$250,000,000
Initial General Account Balance (Working Capital)	\$270,000,000
Days Cash on Hand Target (R&R + General Account)	150 days
Decommissioning Assumptions (STP 1/2)	Existing for STP1/2
Decommissioning Assumptions (STP 3/4) <sup>1</sup>	\$27.2M/yr for 3/4
Income Tax Rates, Federal and State (%)	Exempt
Property Tax Rates (%)	Exempt

Note: 1. Excludes fuel decommissioning.



## Capital Cost and O&M Escalation Forecast





## Power Plant Retirement Assumptions

Year Retired	Generating Unit	In-Service Dates	Type	Net Capacity (MW)
2009	WBTuttle: 1	June 16, 1954	Gas Steam Turbine (existing)	65
2009	WBTuttle: 4	March 19, 1963	Gas Steam Turbine (existing)	160
2010	WBTuttle: 3	March 28, 1961	Gas Steam Turbine (existing)	100
2010	Leon Creek: 3	May 28, 1953	Gas Steam Turbine (existing)	65
2010	Leon Creek: 4	May 5, 1959	Gas Steam Turbine (existing)	95
2021	VHBraunig: 1	May 3, 1966	Gas Steam Turbine (existing)	220
2023	VHBraunig: 2	May 5, 1968	Gas Steam Turbine (existing)	230
2025	VHBraunig: 3	August 1, 1970	Gas Steam Turbine (existing)	412
2027	OWSommers: 1	June 6, 1972	Gas Steam Turbine (existing)	430
2029	OWSommers: 2	March 20, 1974	Gas Steam Turbine (existing)	420
2032	JTDeely: 1	August 8, 1977	Coal Steam Turbine (existing)	446
2033	JTDeely: 2	August 1, 1978	Coal Steam Turbine (existing)	446



## Resource Options

### Combined Cycle:

- 7FB Class CT, 2X1
- 593 MW net
- 100% natural gas
- DLN Combustor, SCR
- Inlet evaporative cooler
- 50% capacity factor for bus bar analysis

### Nuclear:

- ABWR
- 1,350 MW net per unit
- 10,200 Btu/kWh heat rate
- Refueling every 18 months with a 19-day duration
- 85% capacity factor for bus bar analysis

### Supercritical Pulverized Coal With CO<sub>2</sub>:

- Steam conditions 3500 psig/1050° F/1050° F
- 510 MW net
- 100% PRB fuel
- SCR, Baghouse, Wet FGD
- 90% CO<sub>2</sub> capture
- CO<sub>2</sub> storage and transportation expense included
- 85% capacity factor for bus bar analysis

### Notes:

1. The assumed capacity factors for bus bar analysis are only used to compare all technologies on the same basis. Nuclear technology should realistically achieve a capacity factor exceeding 90%, which means the 85% value is conservative. The 85% value was chosen as the maximum capacity factor since SCPC and IGCC technologies are expected operate in this range.



## Resource Options (cont.)

### IGCC With CO<sub>2</sub>:

- Shell gasifier, GE 7FB gas turbines 2X1, Selexol Acid Gas Recovery, SCR
- 523 MW net
- 100% PRB fuel
- 90% CO<sub>2</sub> capture
- CO<sub>2</sub> storage and transportation expense included
- 85% capacity factor for bus bar analysis

### Solar:

- Solar Thermal - Concentrating Parabolic Trough
- 6 Hrs Storage
- 100 MW net per unit
- Lubbock, Texas hourly profile from DOE Solar Advisor Model Version 1.3
- 2.6 Solar multiple
- 41% capacity factor for bus bar analysis

### Wind:

- 1.5 MW per unit wind turbine generator
- 34% capacity factor for bus bar analysis

#### Notes:

1. The assumed capacity factors for bus bar analysis are only used to compare all technologies on the same basis. Nuclear technology should realistically achieve a capacity factor exceeding 90%, which means the 85% value is conservative. The 85% value was chosen as the maximum capacity factor since SCPC and IGCC technologies are expected operate in this range.
2. Energy and capacity market purchases were included in the bus bar analysis, to achieve an equivalent 85% capacity factor for the combined cycle, solar, and wind technologies.
3. The 41% capacity factor for solar bus bar analysis is from DOE Solar Advisor Model Version 1.3 using assumed design parameters.
4. The 34% capacity factor for wind bus bar analysis is based on average historical performance of West Texas wind plants.

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## Resource Operating Assumptions

Operating Parameter		Comb. Cycle Nat Gas	Wind	ABWR Nuclear	IGCC Coal w/CCS	Supercrt Pulv. Coal w/ CCS	Solar Trough w/ Storage
Capacity (Net per Unit)	MW	593	2	1,350	523	510	100
Heat Rate	Btu/kWh	7,132	N/A	10,200	12,012	12,243	N/A
Fixed O&M (2008 \$)	\$/kW-yr	12.17	24.70	97.91	28.70	55.52	90.62
Variable O&M (2008 \$)	\$/MWh	2.37	1.96	0.00	3.35	6.97	1.44
CO <sub>2</sub> Emission Rate	lbs/mmBtu	123	0	0	21.3	21.3	8,300 ton/yr
No <sub>x</sub> Emission Rate	lbs/mmBtu	0.033	0.000	0.000	0.050	0.050	11.3 ton/yr
SO <sub>2</sub> Emission Rate	lbs/mmBtu	0.0006	0.0000	0.0000	0.0040	0.1000	0.15 ton/yr

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## Resource Capital Cost Assumptions

	Comb. Cycle Nat Gas	Wind	ABWR Nuclear	IGCC Coal w/CCS	Supercrt Pulv. Coal w/ CCS	Solar Trough w/ Storage
Existing or New Site	Existing	New	Existing	New	New	New
Overnight Cost (2008 \$/kW) <sup>1</sup>	\$ 739	2,000	\$ 3,671 <sup>2</sup>	\$ 4,476	\$ 5,219	\$ 9,000
Overnight Cost Uncertainty (%)	- 10 +15	- 10 +15	- 6 +50	- 10 +15	- 10 +15	- 10 +20

Notes:

1. The "overnight" cost is the cost of the physical plant as if it were built in one day, with no escalation and with no interest during construction cost included. The construction costs reflect the projected cost of the plants considering equipment, materials, labor, and commodities.
2. The ABWR Nuclear cost estimate is a "generic" estimate based on ABWR technology, adjusted for some site specifics of STP. This generic cost estimate will be different from the project-specific cost estimate.
3. CPS Energy is a municipally-owned, tax-exempt, utility that cannot directly utilize federal, state, or local tax incentives (e.g. investment tax credit, production tax credit, accelerated depreciation, etc.) to potentially reduce the construction and/or production cost of a new electric generation resource. In this analysis only CPS Energy owned and operated assets are evaluated, as such, tax incentives are not included.

CCS = Carbon capture & storage

ABWR = Advanced boiling water reactor

IGCC = Integrated gasification combined cycle

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## Wholesale Power Price Assumptions

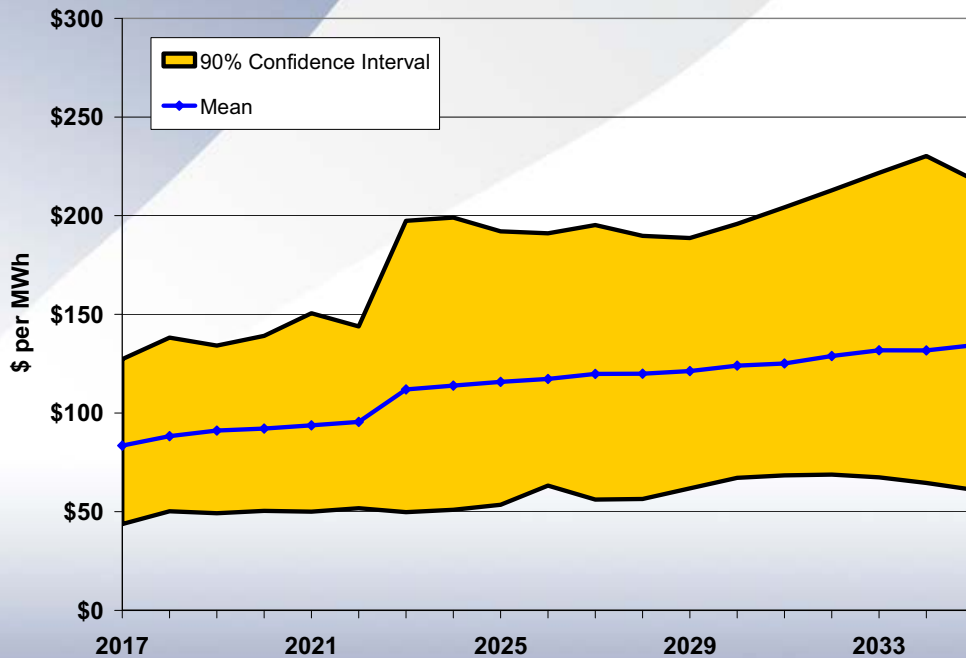
- Hourly ERCOT energy price projection was developed using econometric model
- ERCOT capacity price projections were based on:
  - New gas peaking unit capital cost
    - For capacity shortfall up to peak demand
  - Econometric model
    - For capacity shortfall above peak demand, up to the 12.5% reserve margin target

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## ERCOT Average Annual Energy Prices

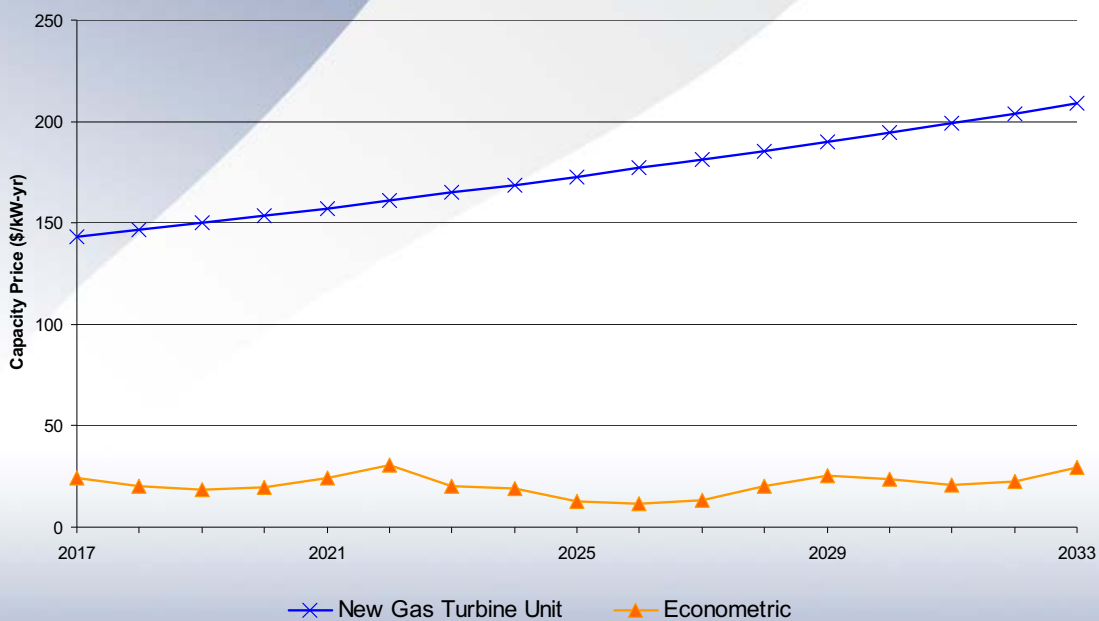


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## Annual Capacity Prices Econometric Model & New Gas Unit



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## Wholesale Power Market Assumption Risks

- Wholesale power prices have two key embedded risks:
  - Natural gas prices
  - Market efficiency
- Wide-spread fuel switching from coal to natural gas in response to aggressive carbon legislation may drive natural gas prices much higher than modeled, and ERCOT power prices would likely follow
- Long-range market models do not fully capture risks of sudden events which may lead to periodic price spikes
- Sales of excess generation capacity into the wholesale market were conservatively discounted
  - Net margin on wholesale sales are discounted by approximately 45 to 55%



## Summary

- Conservative assumptions were used
- All assumptions have uncertainty which can impact the analysis results, and appropriate risk factors and probabilities have been incorporated
- Understanding the impact of the assumptions is key to interpreting the final results