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January 06, 2009

## **MEMORANDUM**

**TO:** Power Committee

**FROM:** Michael Schilmoeller  
Power Planning Analyst

**SUBJECT:** Regional Portfolio Model Representation of Uncertainty in Power Plant Construction Cost, Regional Retail Electricity Requirements, and Natural Gas and Wholesale Electricity Prices

The Regional Portfolio Model evaluates resource plans against a host of distinct scenarios for generating plant construction costs, load requirements, and wholesale market electricity and natural gas prices. This presentation presents staff recommendations for such scenarios, which we will refer to as “futures.” This presentation does not call for any Power Committee decision. Staff, however, will seek the guidance of Committee members regarding the representations of these sources of uncertainties.

For each source of uncertainty, the presentation will review the base case and any bounding forecasts. It will then present as many of the 750 futures as the Committee wishes to study. It summarizes the futures, with distributions of each future’s values across the study period.

Construction cost uncertainty is new to the Council’s planning process in the Sixth Power Plan. We will describe in more detail some of the thinking that contributed to our characterization of uncertainty among alternative generation technologies.



## Construction Cost Uncertainty

Michael Schilmoeller  
Power Committee  
Thursday January 8, 2009

## Overview

- Background on construction costs for various technologies
- Discussion of attributes of cost futures
- Presentation of initial set of futures for “overnight” construction cost of
  - CCCT
  - conventional coal
  - IGCC
  - nuclear
  - SCCT
  - wind
  - solar thermal
  - geothermal



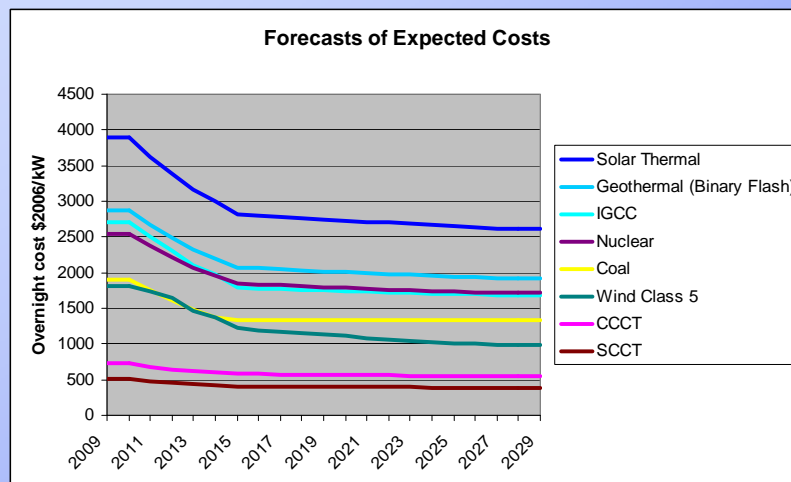
## Attributes of Cost Futures

- Generation Resource Advisory Committee (GRAC) at their December 18, 2008 meeting suggested futures should reflect
  - Expectations about cost trends
  - Greater uncertainty associated with technology that is immature or carries more political baggage
  - Correlation among costs, due to common elements such as steel, switches, labor, and concrete
  - Distinctions due to unique elements, likely reliance on sources outside the United States and associated exchange rate uncertainty, and so forth

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## Expectations



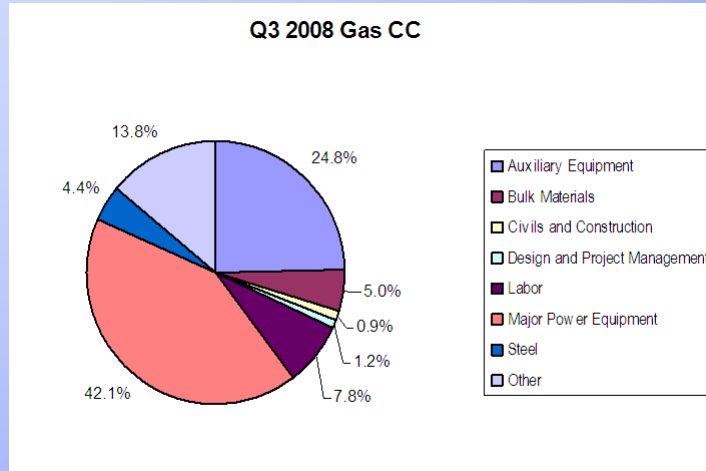
Source: Random Variable 02.xls, worksheet "Graphs of Futures"

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# Cost Matrices

Q3 2008 Gas CC

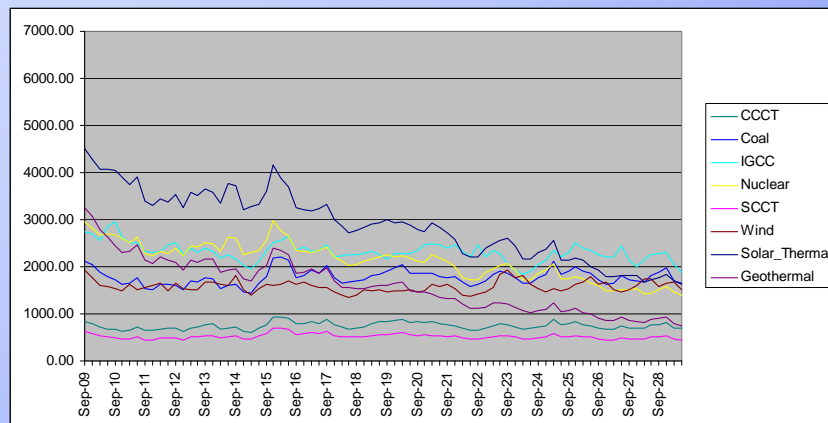


Source: 2008 Nov 17 CCAF Power Tabular Data \_ MJS.xls, worksheet "Table 2"

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# Individual Futures

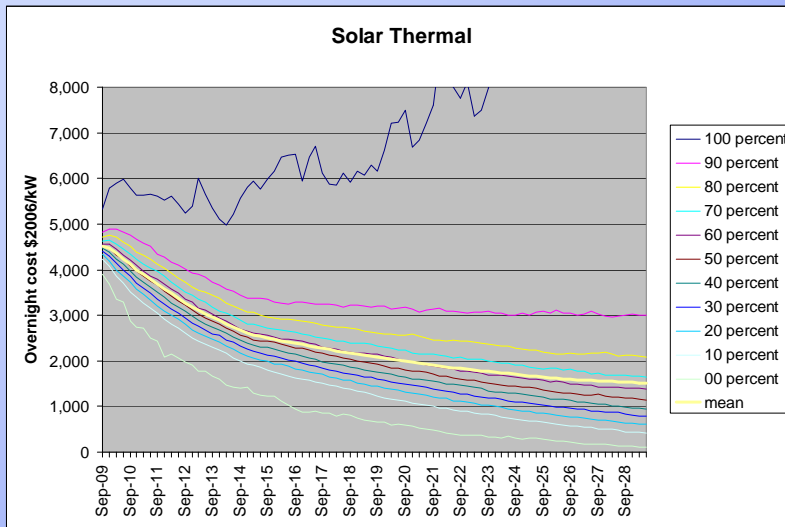


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# Cost Deciles

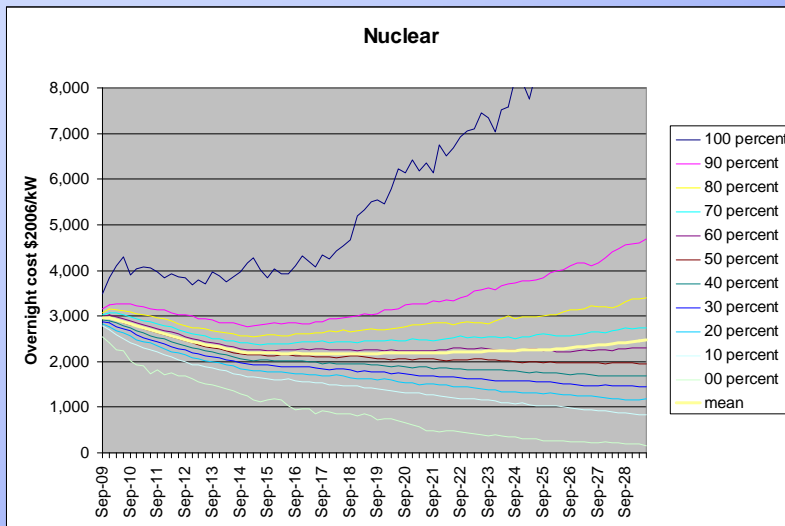


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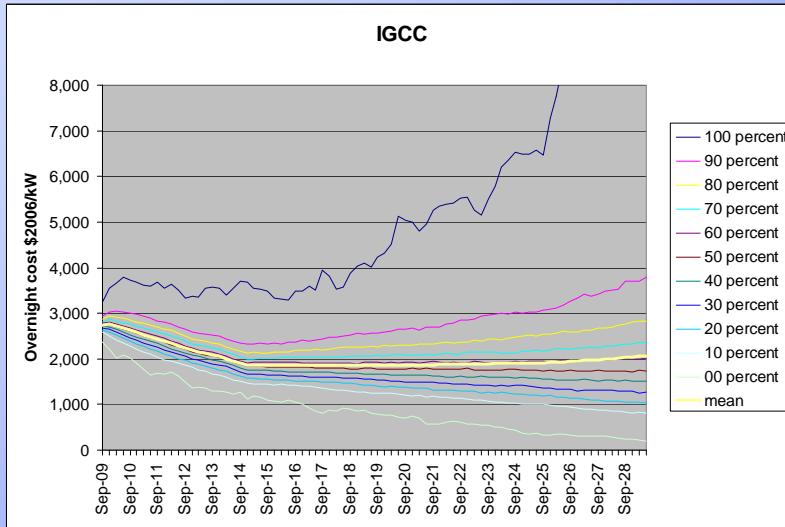


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# Cost Deciles

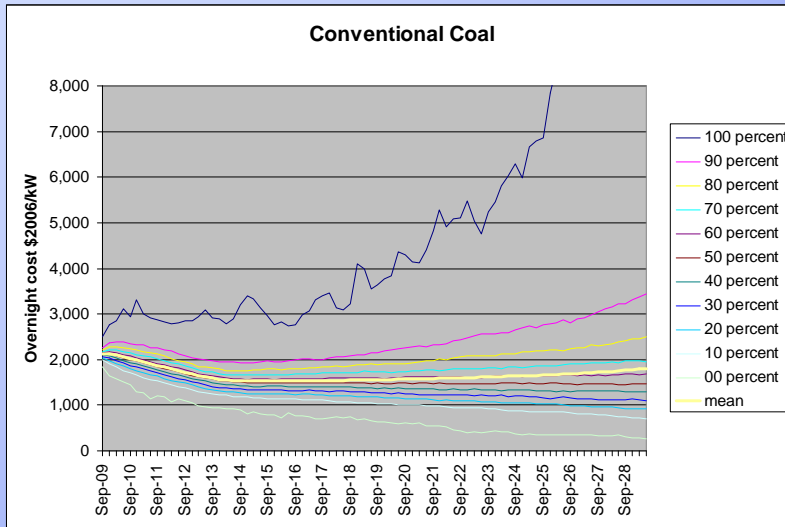


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# Cost Deciles

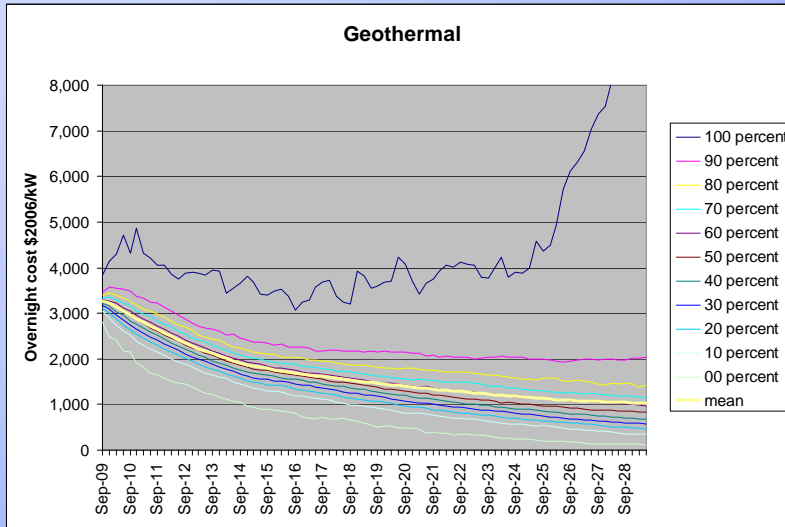


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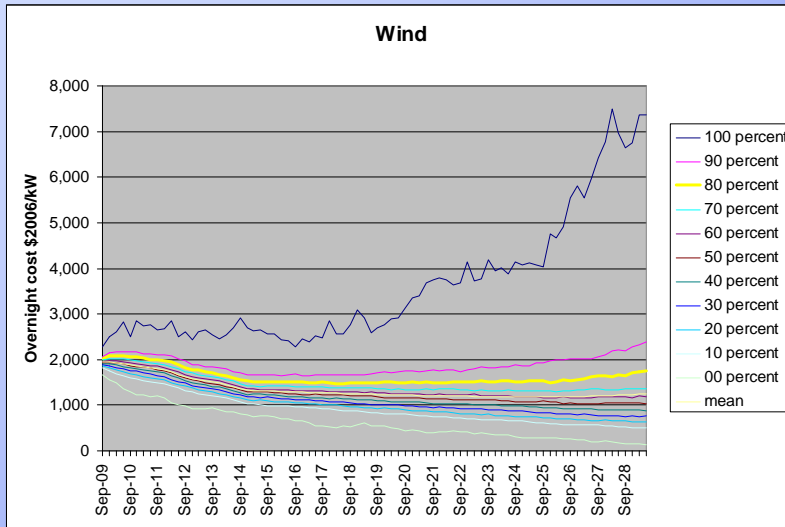


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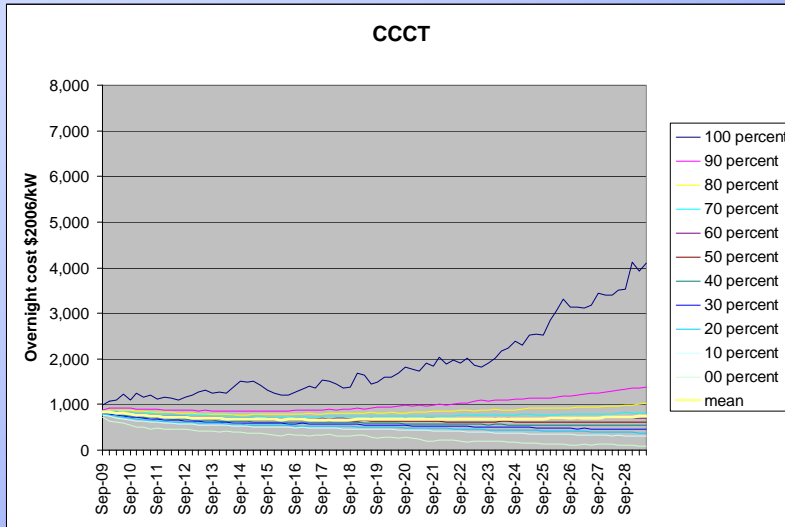


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# Cost Deciles

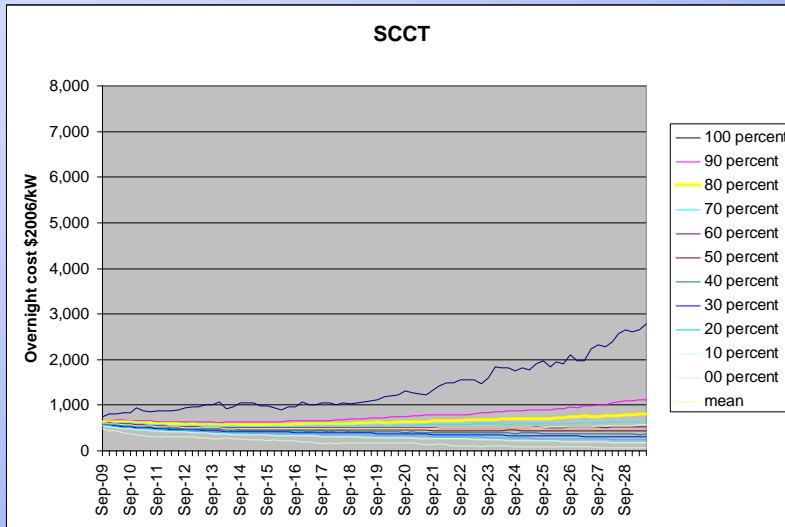


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# Cost Deciles



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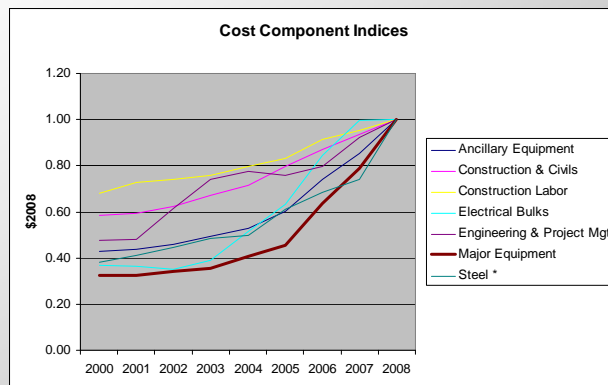


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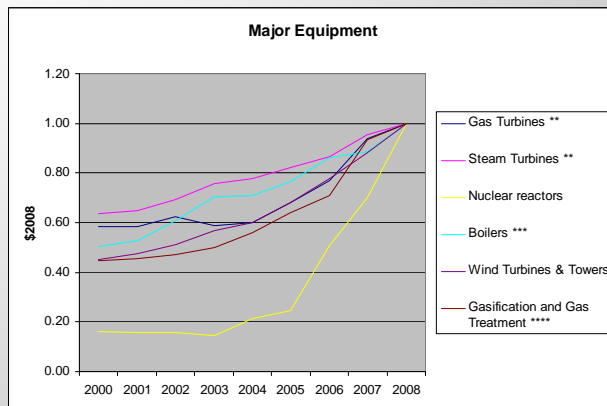
## CERA Cost Components



November 2008 CERA Special Report Capital Costs Analysis Forum—Power: Market Review.

Source: 2008 Nov 17 CCAF Power Tabular Data \_ MJS.xls, worksheet "Table 2"

## CERA Cost Components



Source: Cambridge Energy Research Associates.  
Notes: All historic figures in actual, nominal terms.  
\* Steel index has been reconstructed since the Q1, 2008 report  
\*\* Gas and steam turbine index were combined in the Q1, 2008 report  
\*\*\* Boiler index is slightly changed since Q1, 2008 index due to previous omission with respect to one CFB facility  
\*\*\*\* Gasification and gas treatment will only be added to the overall PCC as of Q3, 2008

Source: 2008 Nov 17 CCAF Power Tabular Data \_ MJS.xls, worksheet "Table 2"

November 2008 CERA Special Report Capital Costs Analysis Forum—Power: Market Review.

## Existing Features

- **Market-Driven Planning**
  - A feature we do not use for our planning: unplanned market additions, at a higher price
- **Early construction – response to circumstances**
  - Existing decision based on market viability and prospective adequacy of the system
  - Mothball and cancellation options
  - Option to incur all expenses in the first period

## New Features

- Overnight construction cost uncertainty
  - Applies to mothball and cancellation costs as well
- Distinct costs if mothballed or cancelled in the first period of early construction
- Fixed operations and maintenance (FOM) cost uncertainty
- Capacity uncertainty
- Decision criterion re-evaluated with revised going-forward cost only

## New Features

- Economic retirements
  - Based on covering FOM, optionally FOM with uncertainty
- Internal, cohort-specific calculation of decision criterion
  - VOM uncertainty optional
- Uncertainty in availability for immature technologies, transmission completion, u.s.w.
- Distinct construction cost rates in early and late phases
- Cohort-specific stochastic forced outages