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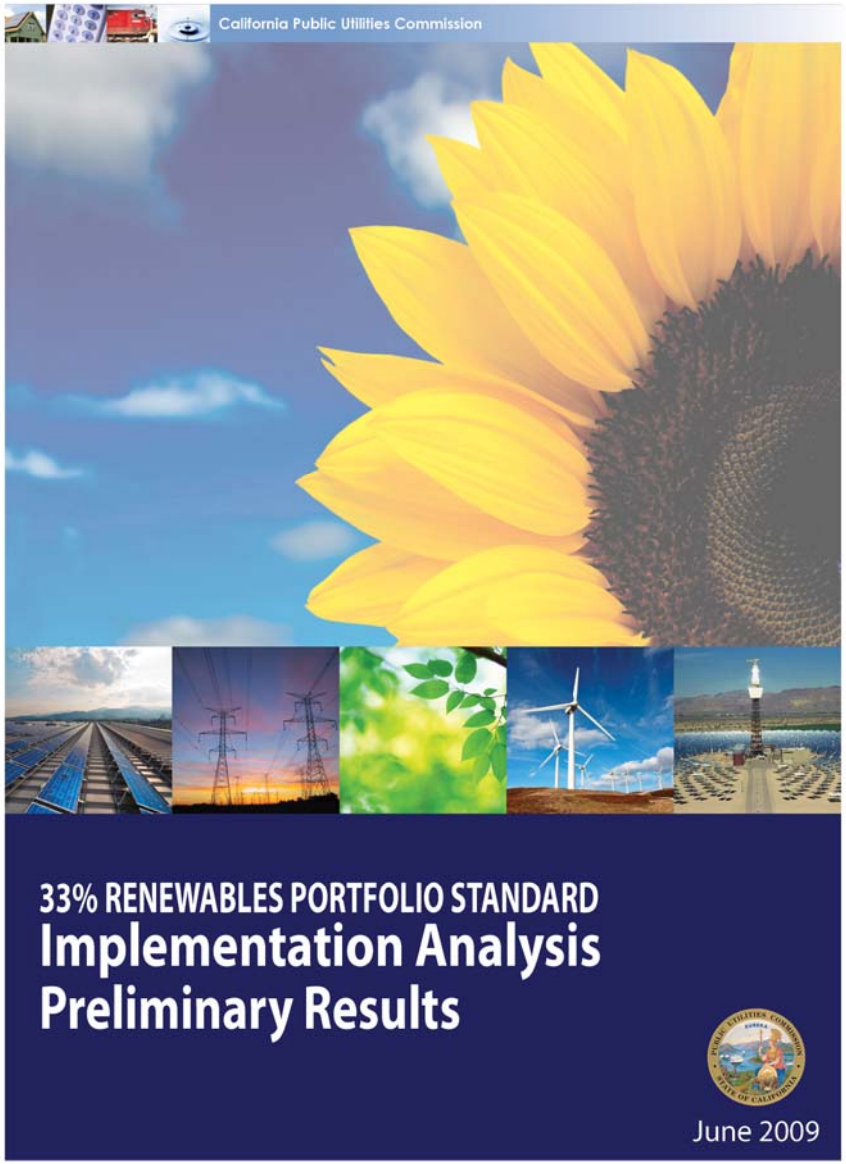


33% RPS Implementation Analysis

Preliminary Results

CPUC Presentation at

"Electricity System Implications of 33 Percent Renewables"
Energy Commission Workshop

June 29, 2009

Purpose and Scope of Analysis

- CPUC's Energy Division staff initiated this analysis in order to answer two key questions:
  - What steps will the state need to take to reach a 33% RPS by 2020?
  - How much will it cost to meet a 33% RPS by 2020?
- Scope of analysis included:
  - Estimate the amount of generation and transmission needed to reach a 33% RPS
  - Several procurement strategies (cases) for achieving a 33% RPS by 2020
  - Calculated the projected cost of different RPS cases in the year 2020
  - Timelines for generation and transmission facilities needed to reach a 33% RPS

33% RPS Resources Needed

20% RPS Reference Case would require	33% RPS Reference Case would require
35 TWh of new renewable electricity in 2020, in addition to **27 TWh** of generation from renewables in existence at the end of 2007	**75 TWh** of new renewable electricity in 2020, in addition to **27 TWh** of generation from renewables in existence at the end of 2007
4 New Major Transmission Lines	**7** Additional Major Transmission Lines

- Renewable need calculated using 2007 IEPR Load Forecast projected out to 2020, minus renewable generation at the end of 2007

Evaluated Renewable Portfolio Options for Achieving 33% RPS

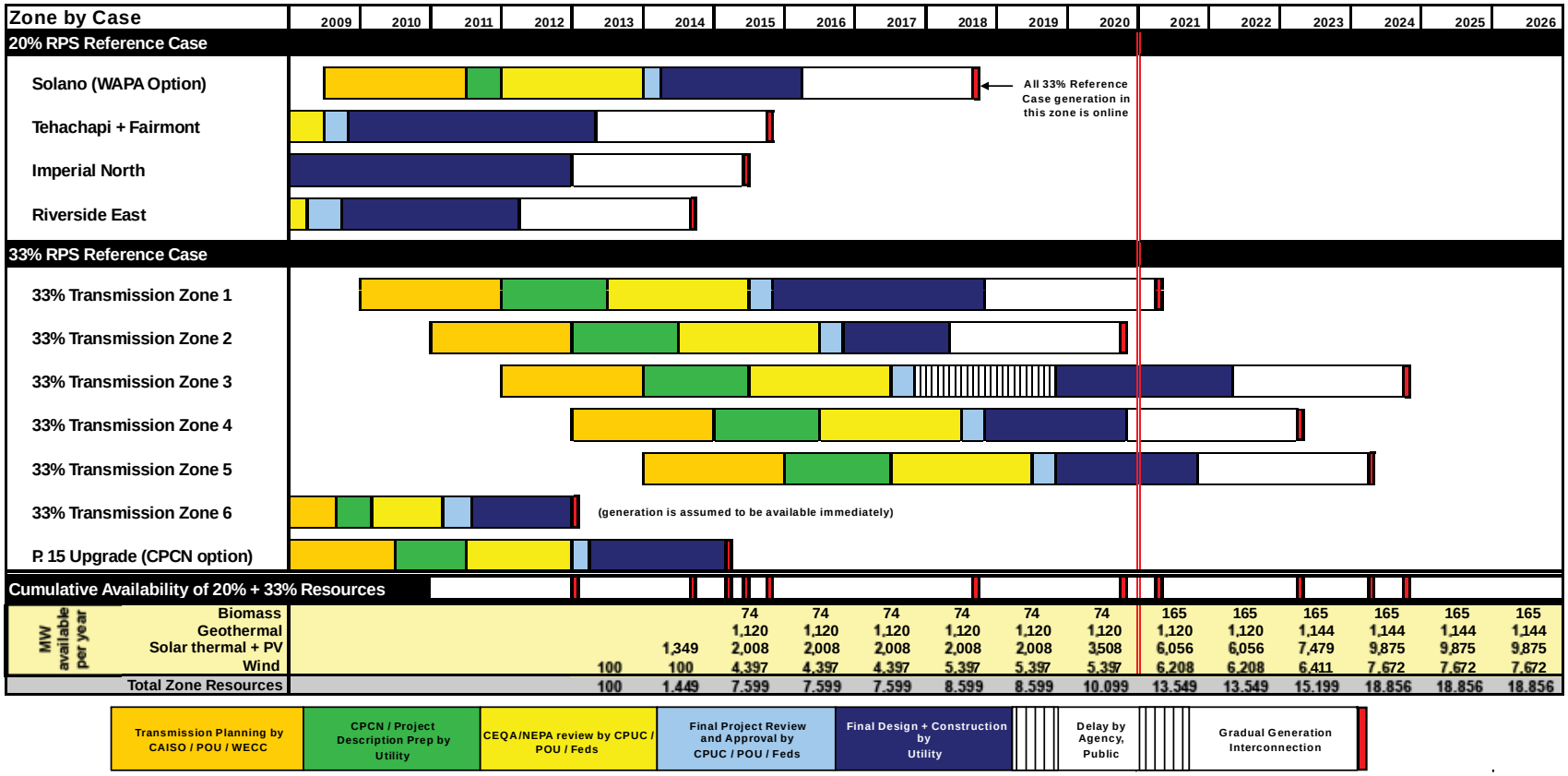
Case Name	Description
20% RPS Reference Case	Utilities procure 35 TWh of additional renewables to meet a 20% RPS target by 2020.
33% RPS Reference Case	Utilities procure 75 TWh of additional renewables to meet a 33% RPS target by 2020. There is heavy emphasis on projects that are already either contracted or short-listed with California IOUs, which includes a significant proportion of solar thermal and solar photovoltaic resources.
High Wind Case	Assumes less reliance on in-state solar thermal and more reliance on the less expensive wind resources in California and Baja.
High Out-of-State Delivered Case	Allows construction of new, long-line, multi-state transmission to allow California utilities to procure large quantities of low-cost wind and geothermal resources in other western states. Does not use tradable renewable energy certificates as a compliance tool. Thus, all out-of-state electricity is delivered to California.
High DG Case	Assumes limited new transmission corridors are developed to access additional renewable resources to achieve a 33% RPS. Instead, extensive, smaller-scale renewable generation is located on the distribution system and close to substations.

- 33% RPS reference case is current RPS portfolio plus planned procurement
- Implementation assessment only done on 20% and 33% RPS reference cases
- More analysis is needed to determine if alternative 33% RPS cases can be implemented

33% RPS Reference Case Timelines

- **Timeline 1 (Historical experience without process reform)**
  - 33% RPS achieved in 2024
  - Assumes no external risks and that planning, permitting, and construction processes are almost entirely sequential
- **Timeline 2A (Current practice with process reform & no external risks)**
  - 33% RPS achieved in 2021
  - Assumes successful implementation of reforms currently in process
  - Timeline assumes no delays due to external risks beyond state control
- **Timeline 2B (Current practice with process reform & external risks)**
  - 33% RPS not achieved
  - Assumes state successfully implements reforms, but factors outside state control (e.g., technology failure, financing risk, environmental risk, and public opposition/legal challenges) cause delay or failure of some transmission and generation projects

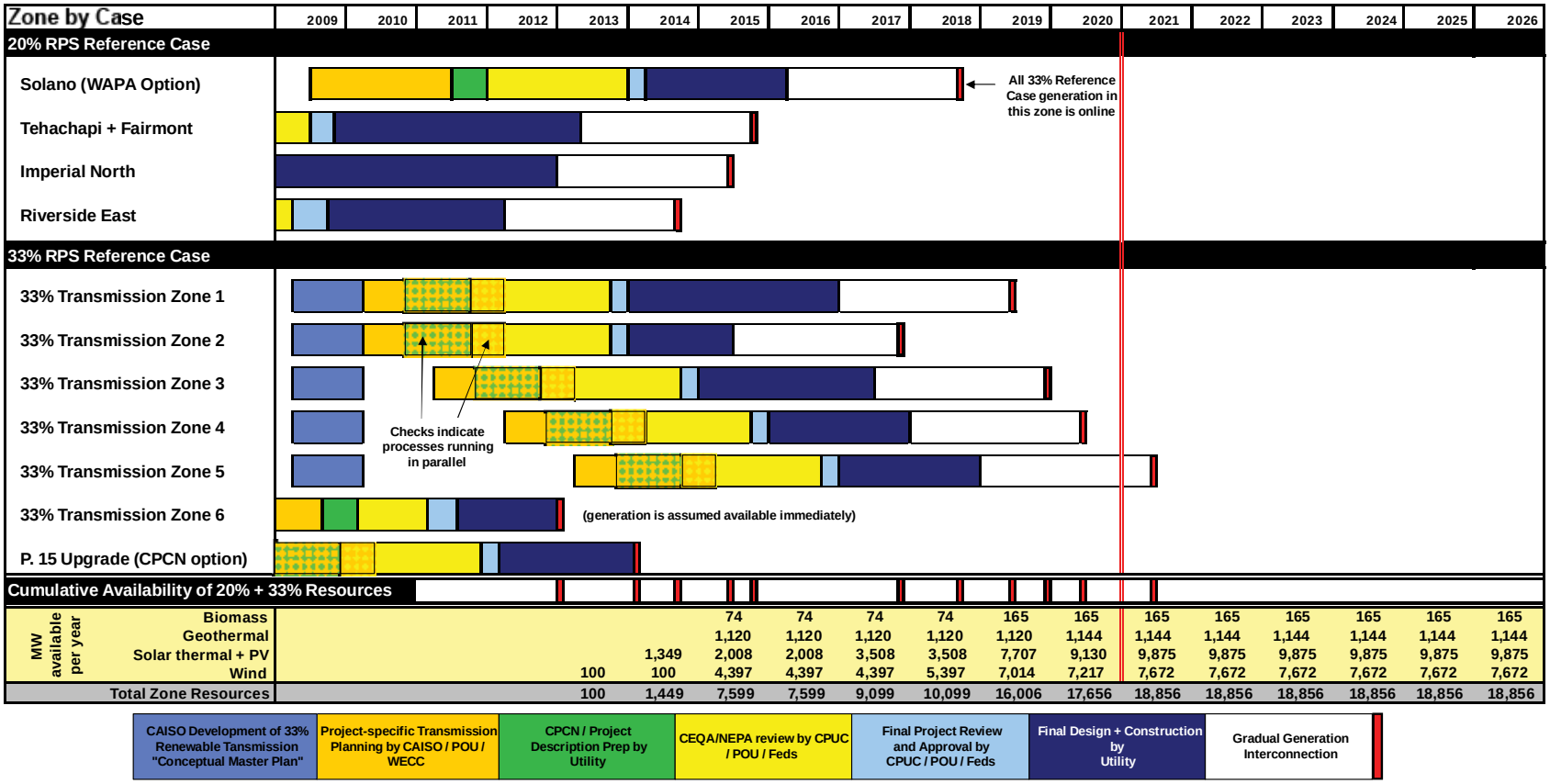
Timeline 1 - Historical Experience Without Process Reform



Source: CPUC/Aspen

- **Result: 33% RPS achieved in 2024**

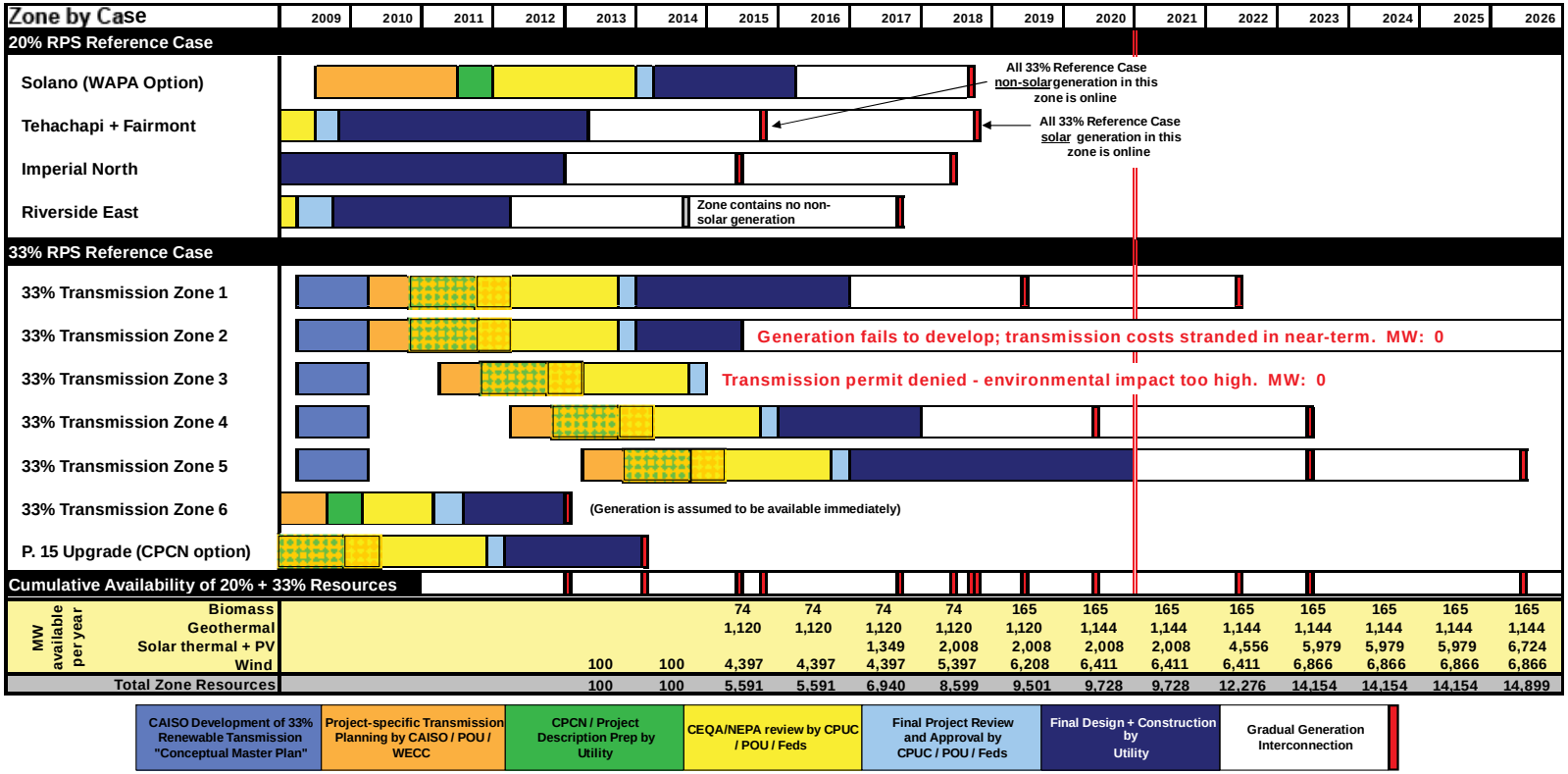
Timeline 2A - Current Practice With Process Reform & No External Risks



Source: CPUC/Aspen

- **Result: 33% RPS achieved in 2021**

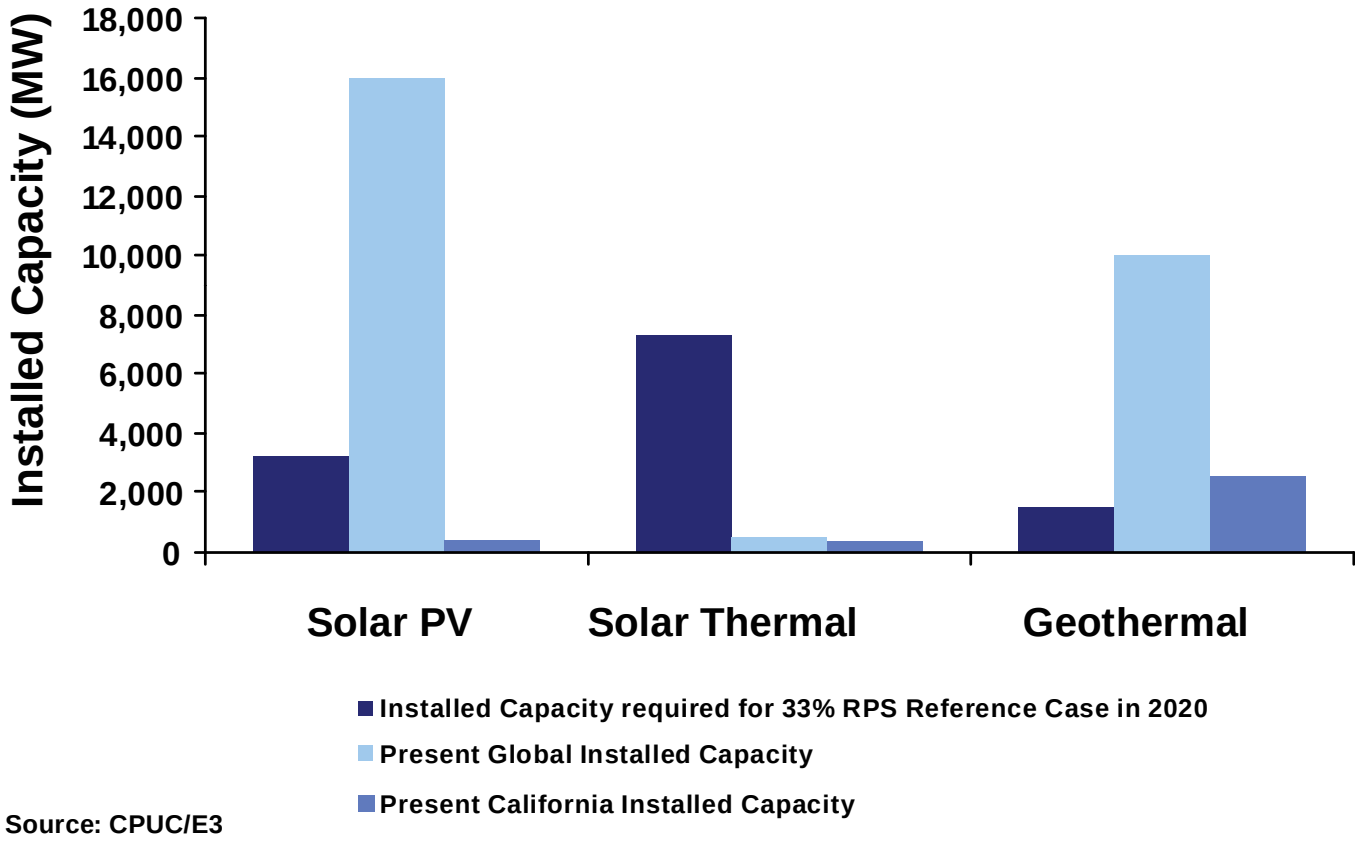
Timeline 2B - Current Practice With Process Reform & External Risks



Source: CPUC/Aspen

- **Result: 33% RPS is not achieved, mitigating strategies are needed**

Example of External Risk
Technology Risk



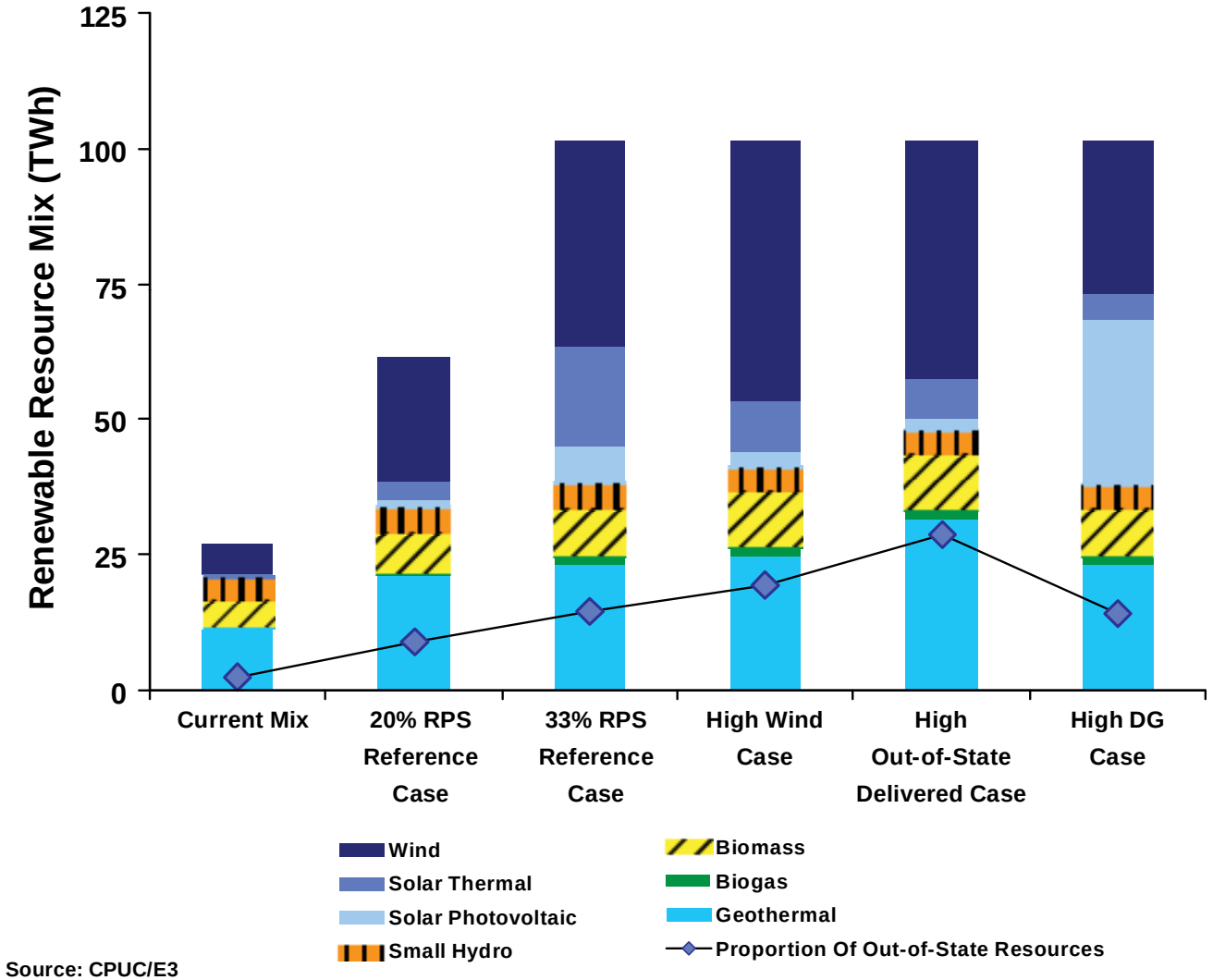
Source: CPUC/E3

- 33% RPS Reference Case includes over 7,000 MW of proposed solar thermal projects and over 3,000 MW of proposed solar PV

Examples of Mitigating Strategies

- Current procurement path is focused almost solely on central station renewable generation that is dependent on new transmission
- Procurement strategy that adequately considers the time and risk, in addition to price, associated with particular renewable generation resources is needed
- The state may also wish to adopt risk mitigation strategies, such as:
  - Planning for more transmission and generation than needed to reach just 33%
  - Pursuing procurement, such as distributed solar PV, which is not dependent on new transmission
  - Concentrating renewable development in pre-permitted land that would be set aside for a renewable energy park

Renewable Resource Mixes in 2020 Under Different Cases



Source: CPUC/E3

Electricity Costs Will Increase in 2020, Regardless of RPS Requirements

Category	2008	All-Gas Scenario in 2020	20% RPS Reference Case in 2020	33% RPS Reference Case in 2020
Existing and New Conventional Generation Fixed Costs*	$8.5	$11.8	$11.1	$9.9
Existing and New Conventional Generation Variable Costs*	$13.2	$16.5	$14.2	$11.6
Existing Transmission and Distribution*	$15.1	$20.5	$20.5	$20.5
New Transmission for Renewables*	N/A	N/A	$0.5	$1.8
New Renewable Generation and Integration*	N/A	N/A	$4.3	$10.8
CO_2 Allowances*	N/A	$0.4	- $0.03	- $0.5
Total Statewide Electricity Expenditures*	**$36.8**	**$49.2**	**$50.6**	**$54.2**
Average Statewide Electricity Cost per kWh	**$0.132/kWh**	**$0.154/kWh**	**$0.158/kWh**	**$0.169/kWh**

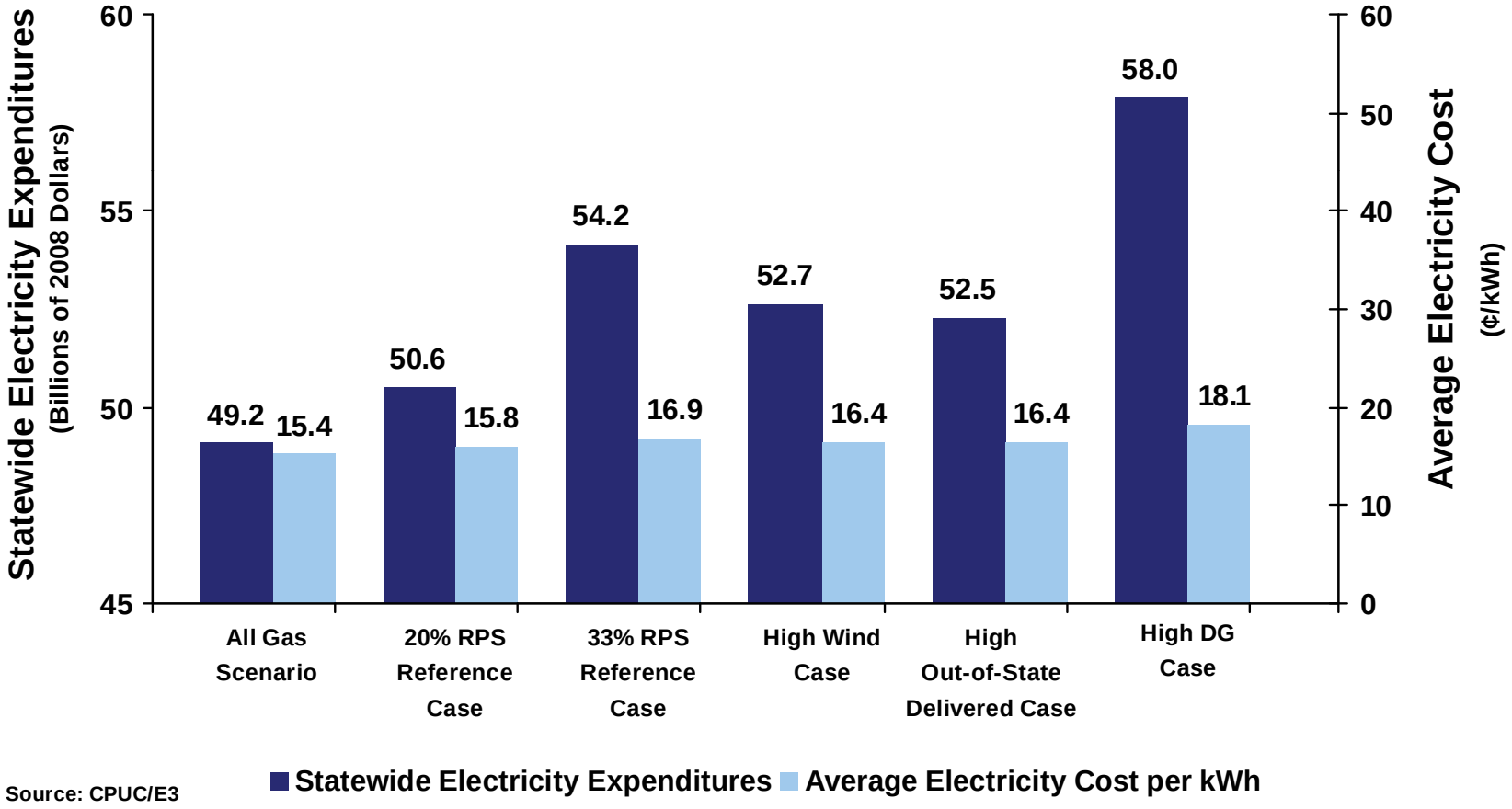
*Expressed in billions of 2008 dollars in 2020.

33% RPS Reference Case 7.1% Higher than 20% RPS Reference Case

Category	20% RPS Reference Case	33% RPS Reference Case	33% High Wind Case	33% High Out-of-State Delivered Case	33% High DG Case
Total Statewide Electricity Expenditures*	$50.6	$54.2	$52.7	$52.5	$58.0
Average Statewide Electricity Cost per kWh	$0.158/kWh	$0.169/kWh	$0.164/kWh	$0.164/kWh	$0.181/kWh
Difference Relative to 20% RPS Reference Case*	N/A	+$3.6	+$2.1	+$1.9	+$7.4
Percent Difference Relative to 20% RPS Reference Case	N/A	+7.1%	+4.2%	+3.8%	+14.6%
Difference Relative to 33% RPS Reference Case*	N/A	N/A	-$1.5	-$1.7	+$3.8
Percent Difference Relative to 33% RPS Reference Case	N/A	N/A	-2.8%	-3.1%	+7.0%

*Expressed in billions of 2008 dollars in 2020.

The 33% RPS Reference Case is the Most Expensive Case that Needs New Transmission

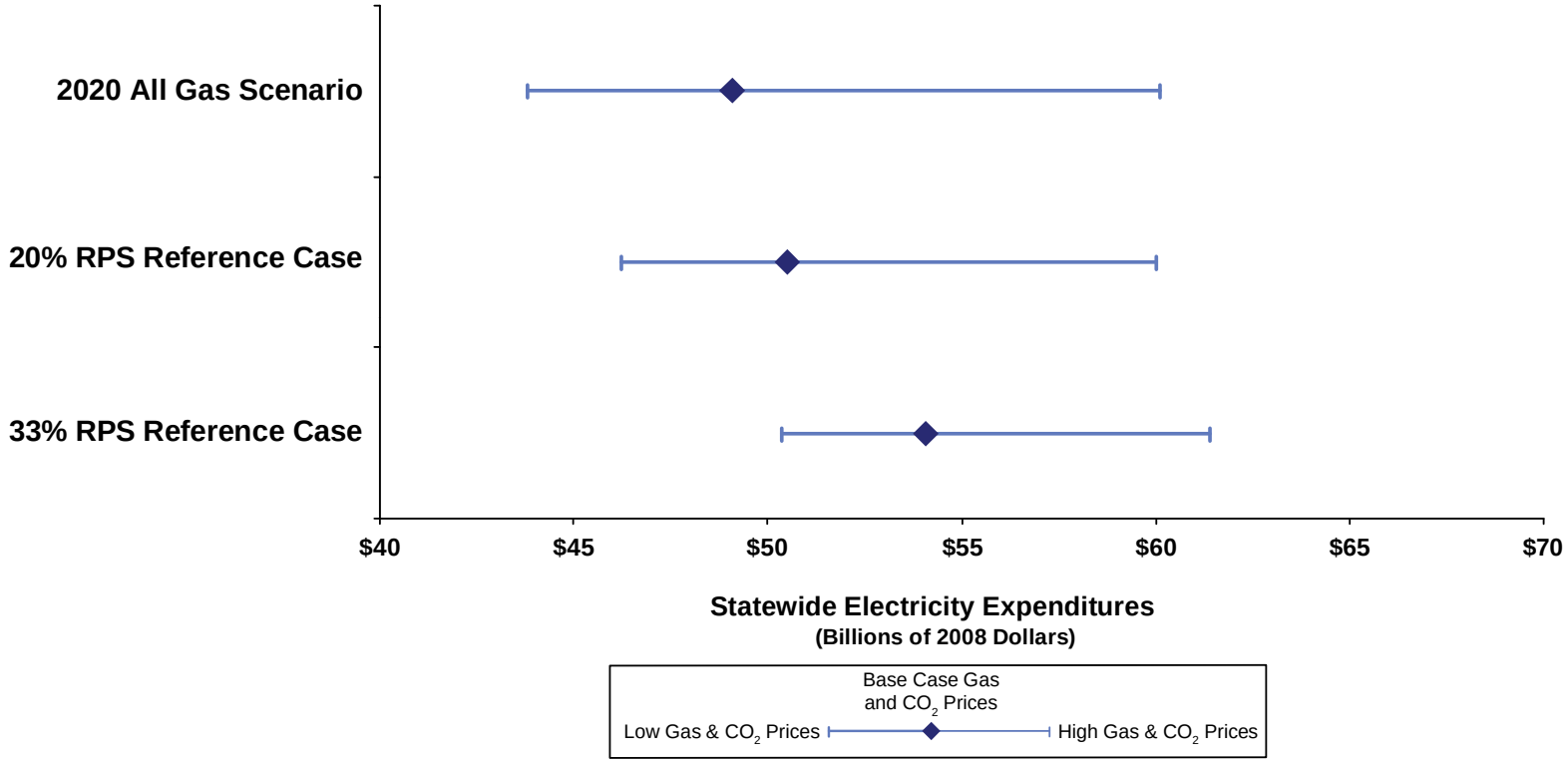


Source: CPUC/E3

Sensitivity Analysis

- Projecting the costs of different renewable and fossil-fired energy sources out to 2020 requires numerous assumptions about future conditions including:
  - Natural gas and GHG allowance prices
  - Load growth (low-load scenario)
  - Technology costs (solar PV cost reductions)
- Many of these variables are highly uncertain, and some significantly influence the model's results

Impact of Gas and CO_2 Allowance Prices on Statewide Expenditures



- A 33% RPS can serve as a hedge against natural gas prices, but only under very high natural gas and GHG allowance prices
- Hedging value in itself is not a very strong justification to do a 33% RPS

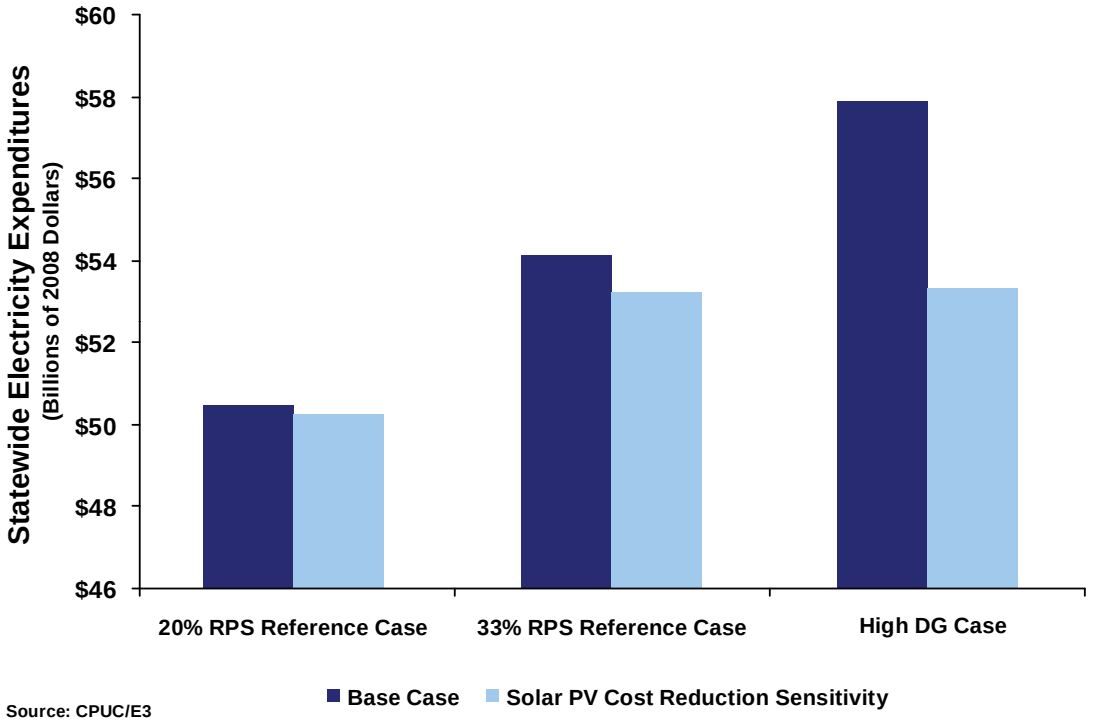
Impact of High Energy Efficiency Achievement (Low-Load Sensitivity)

Costs	Base Case Loads	Low-Load Sensitivity
Total Electricity Expenditures, 20% RPS Reference Case *	$50.6	$46.4
Total Electricity Expenditures, 33% RPS Reference Case *	$54.2	$50.4
Incremental cost of 33% RPS Reference Case *	$3.6	$4.0
Percent Difference Relative to 20% RPS Reference Case	7.1%	8.6%

*Expressed in billions of 2008 dollars in 2020.

- The interplay between energy efficiency achievement and renewable energy procurement highlights the need to analyze and plan for the interactions among the state's various policy goals
- If the state does not plan for interactions, then a 33% RPS by 2020 could result in a surplus of energy or capacity and excess consumer costs

Cost Savings Due to Solar PV Cost Reduction Sensitivity



Source: CPUC/E3

- Dramatic cost reductions in solar PV could make a solar DG strategy cost-competitive with central station renewable generation
- More analysis is necessary to determine the programmatic strategies necessary to achieve a high-DG scenario as well as the feasibility of high penetrations of solar PV on the distribution grid

Achieving a 33% RPS requires tradeoffs between various policy goals and objectives

Criteria	33% RPS Reference Case	High Wind Case	High Out-of-State Delivered Case	High-DG Case
Cost	◒	●	●	○
Timing	○	◒	◒	◒
GHG Emission Reductions	●	●	●	●
Resource Diversity (Hedging Value)	●	●	●	●
Local Environmental Quality Air Quality	●	◒	○	●
Local Environmental Quality Land Use	○	◒	◒	●
In-state Economic Development	◒	◒	○	◒
Long-Term Transformation	●	○	○	●
Technology Development Risk	○	●	●	○

Legend:

● Case performs well ○ Case performs poorly ◒ Case is neutral

Next Steps

- Final report targeted for the end of 2009
- Report will be updated with the following analyses:
  - RETI/California ISO Conceptual Transmission Plans
  - California ISO renewable integration analysis
  - Energy Commission once-through cooling analysis

More Information

- 33% RPS Report and RPS Calculator:
  - http://www.cpuc.ca.gov/PUC/energy/Renewables/hot/33implementation.htm
- CPUC RPS Website
  - www.cpuc.ca.gov/renewables