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Economic Evaluation of Palo Verde Devers Line # 2 (PVD2)

Base Case Assumptions

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Purpose

Base Case Assumptions

Part I Data Assumptions

Part II Modeling Assumptions

Part I

Data Assumptions

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Part I: Data Assumptions

- Inheritance and Modifications
- The current system
- Loads
- Gas prices
- Hydro conditions
- Major interfaces

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Inheritance and Modifications

- Started with SSG-WI database
- Modifications to SSG-WI include:
  - Renewable Portfolio Standard (RPS) by state
  - 16% capacity reserve margin for each sub-region
  - Adjusted reserve margins to WECC projections (2003/2004 forecasts)
  - Updated loads and gas prices (monthly) from CEC forecasts
  - Evaluated economic entry and retirements
  - Network upgrades included short-term upgrades to Palo Verde Devers branch group and EOR 9000
  - Outage optimization
  - Pumped storage optimization

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The System – Year 2008

The System	WECC
Transmission Lines	Total 17,450 3 DC lines 284 lines 500KV or above
Phase Shifters	57 Phase Shifters – None optimized
Nodes	13,383
Interfaces	129 Interfaces Not all enforced
Regions	21
Generators	760 Total 117 Hydro 8 Pumped Storages Approx 40 Renewables (Wind, Biomass, Solar)

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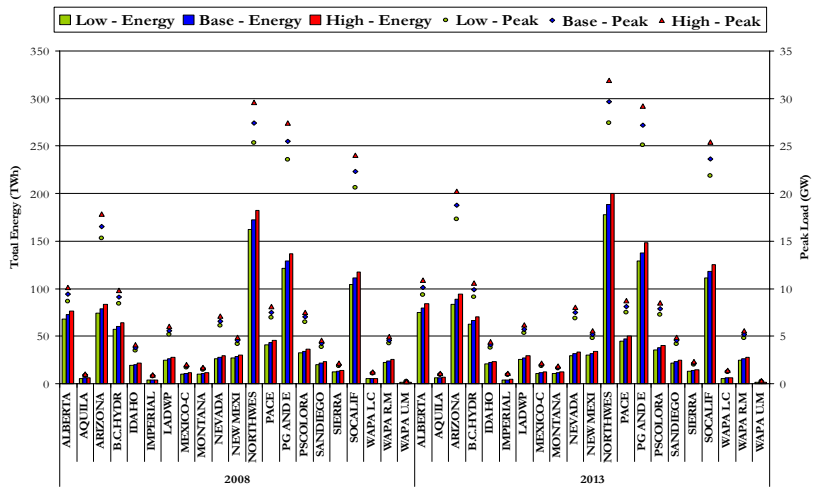
Peak Load & Energy



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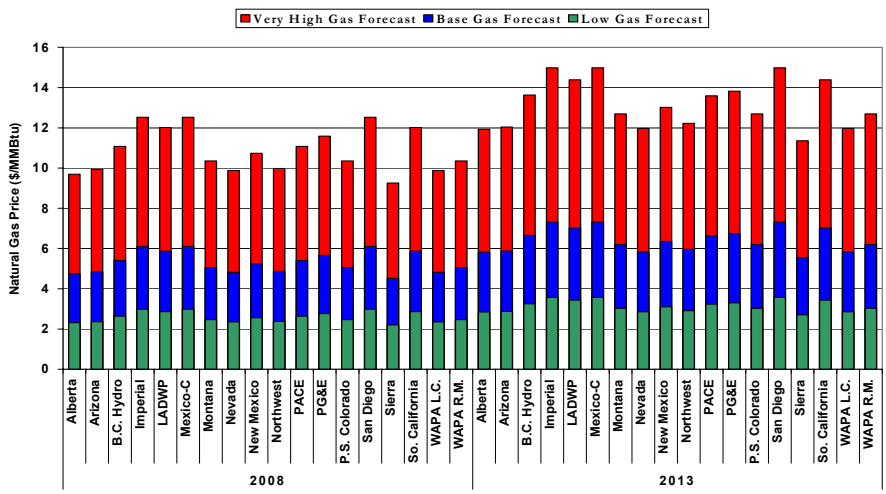
Gas Prices - Annual Average by Region



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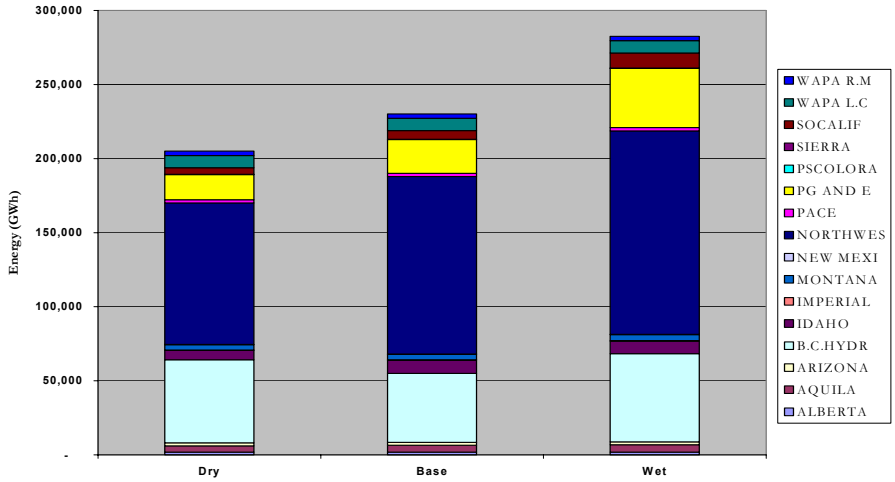
Hydro Energy by Region



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Major Interfaces

Interfaces		Interface Limits (MW)				
		Today	Short Term upgrade	EOR 9000+ project	Base Case	After PVD2
Path 26		3700	3700	3700	3700	3700
Path 15	North-South	3265	3265	3265	3265	3265
	South-North	5400	5400	5400	5400	5400
EOR		7550	8055	9300	9300	10500
WOR		10118	10623	10623	10623	11823
SCIT		15000	19391	19391	19391	20591
PV West		2800	3600	3600	3600	5400
Palo Verde - Devers 1 (&2)		1645	2338	2338	2338	4676
Hassayampa-North Gila		1212	1905	1905	1905	1905
Navajo - Crystal		1411	1411	1808	1808	1808
Moenkopi-Eldorado		1645	1645	1645	2000	2000
Perkins - Mead		1238	1238	1905	1905	1905
PDCI		2700	2700	2700	2700	2700

Data Modeling Limitations

- Hydro not optimized
  - Using the hourly hydro profile used in SSG-WI studies
- Wind
  - Using the hourly profile used in SSG-WI studies
- Transmission losses *
- Wheeling charges *
- Commitment variables *

* Not used in the study.

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Part II

Modeling Assumptions

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Network

- Full network for the interconnected area
- Linearized DC OPF
- Nodal pricing
- Regional sub classification
- Controllable devices
- Nomograms & Interfaces

* Not included in the methodology

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OPF and LMP

- PLEXOS (www.draytonanalytics.com) of Drayton Analytics of Australia
  - Loop Flow – Kirchhoff's Laws
  - Phase Shifter optimization
  - DC flow optimization
  - Transmission nomograms (linear) & interface limits
  - Choice of "Standard" and "Large Scale" OPF
    - Large Scale (used for the study)
      - Topography is static within one simulation
      - Transmission losses calculated ex-post
    - Standard
      - Transmission losses and impact of marginal loss factors on nodal prices
      - Transmission outages and other topographical changes

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Market Pricing Modeling

- Integrated market behavior with transmission network
- Dynamic hourly bidding

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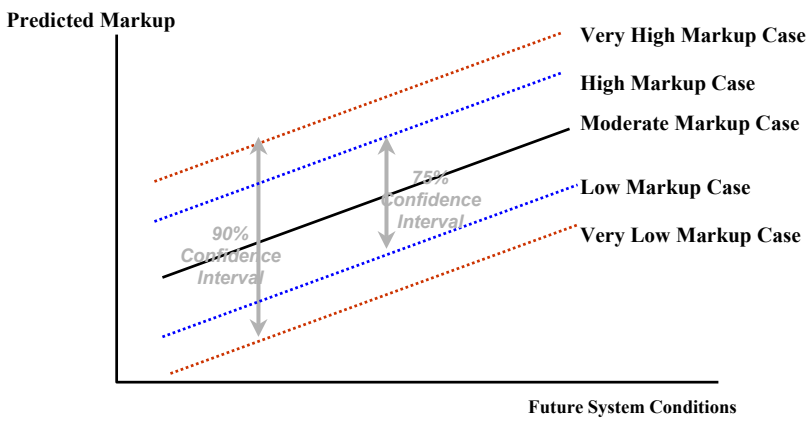
Markups



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Market Pricing

Market Price Regions	3 regions in California PG&E, SCE & San Diego
Contracts	Existing State contracts of 2008. Assumed same for 2013.
RMR	Year 2004 Condition 2 units of CAISO system
Strategic Players	IPP
Non Strategic Players	Utility Generation RMR Units Municipal Generation

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Case List

The **Variables** that varied among the cases, for two years of analysis, 2008 & 2013

1. Gas Prices (Very High, Base, Very Low)
2. Load (Very High, Base, & Very Low)
3. Hydro (Base Wet & Dry)
4. Markup (Moderate, Very High, Very Low)
5. Economic Entry and Retirement (Base)
6. San Onofre permanent outage
7. PDCI line outage
8. Mohave plants coming back in service
9. COI and EOR with reduced OTCs

* The final list of cases still under development, subject to change.

Modifications to TEAM

- Transmission Rental Calculations
- Contract settlements in final benefits

Transmission Rental Calculations

- Also known as Congestion Revenue
- Two methods of calculations
  - Point to Point Method (P2P)
    - Used in TEAM
    - Can be used only for radial networks
  - Flow gate Method (FG)
    - Modified and adopted going forward
    - Good for all radial and looped network

Treatment of Contract Settlement

- Impact of contracts
  - to reduce the seller incentives to exercise market power (No change)
  - how to assign the settlement of the contracts as they may impact the benefits of different parties at different locations
    - Delivery at the load location (TEAM)
    - Delivery at the supply location
    - No assignment
      - Lack of information on contract terms on delivery & pricing.

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