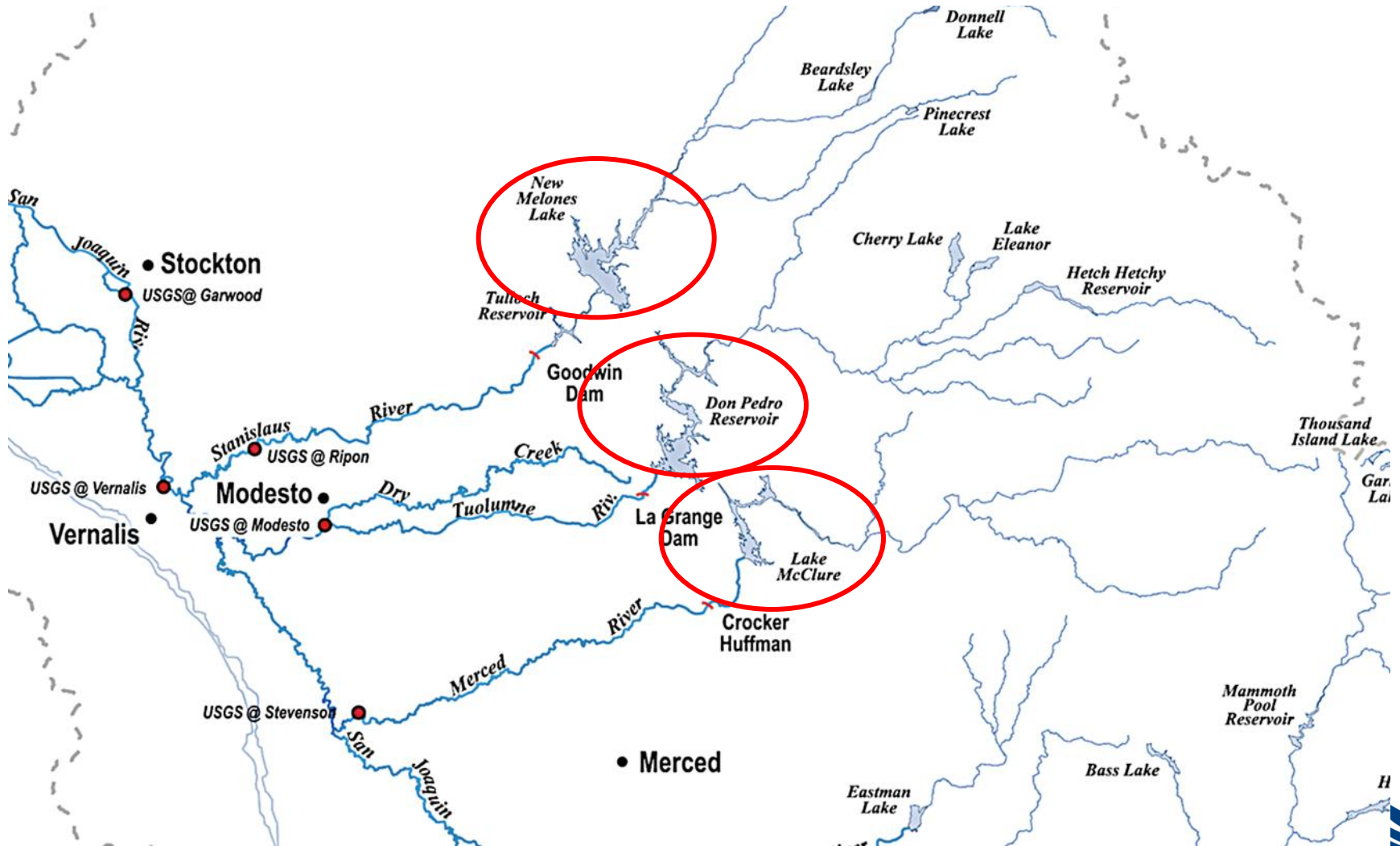


# Hydropower and Electric Grid Analysis of Lower San Joaquin River Flow Alternatives

# Two-Part Analysis

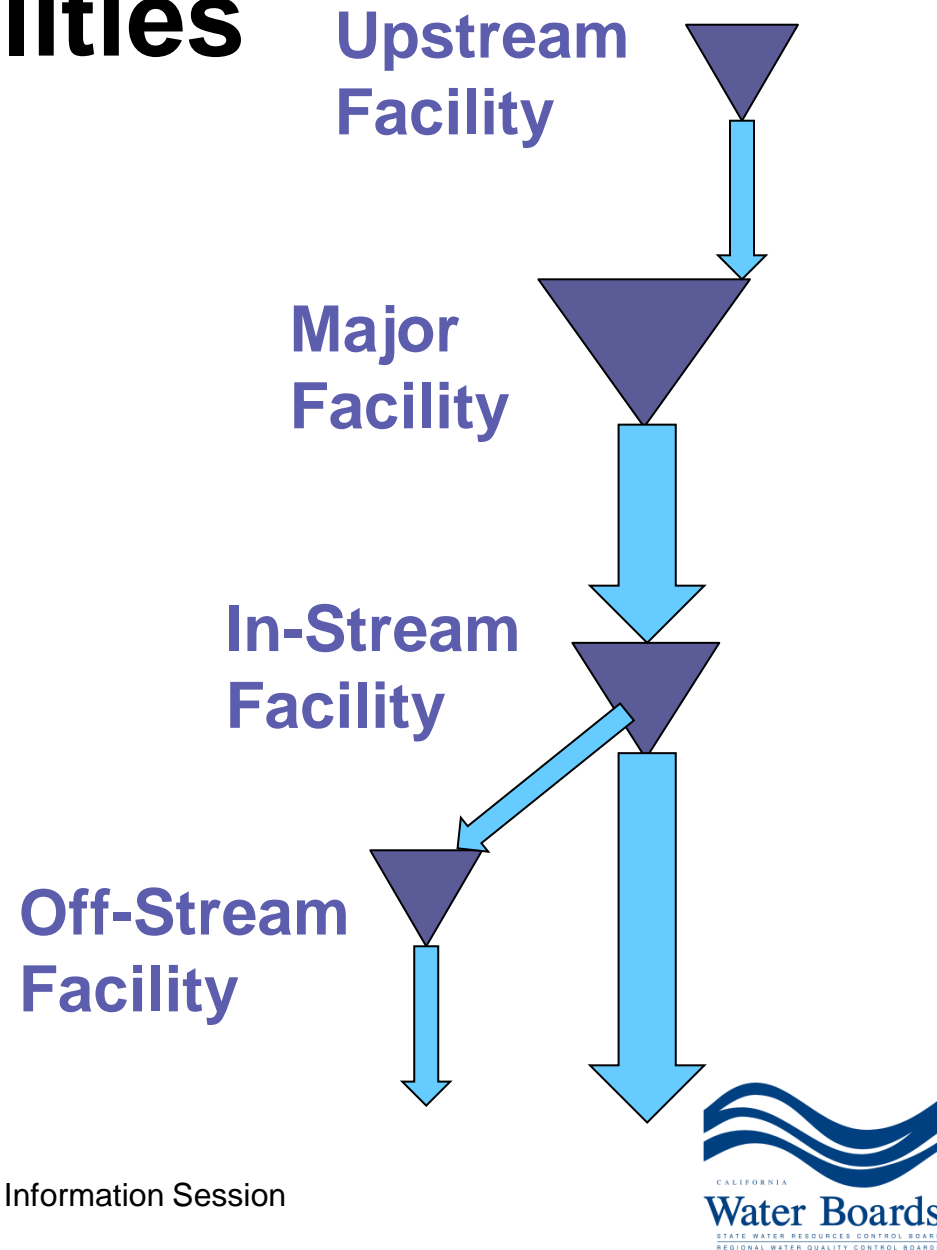
- Monthly hydropower generation
  - Change in timing and magnitude of hydropower generation by month
- Electric grid reliability
  - Effect of reduced generation under summer peak load conditions and contingencies

# Lower San Joaquin River Watershed



# Hydropower Facilities

- Upstream
  - (e.g. R.C. Kirkwood)
- Major Reservoirs
  - (e.g. New Don Pedro)
- In-stream
  - (e.g. La Grange)
- Off-stream
  - (e.g. Turlock Lake)



# Hydropower Facilities

## Facilities by Location and Tributary (# (Nameplate Capacity))

Tributary	Upstream	In-Stream	Off-Stream
<b>Stanislaus</b>	11 (462)	1 (17)	2 (8)
<b>Tuolumne</b>	5 (391)	1 (4)	3 (5)
<b>Merced</b>	0 (0)	2 (19)	3 (6)

Nameplate capacity rounded to nearest megawatt

- New Melones 300 MW
- New Don Pedro 203 MW
- New Exchequer 95 MW

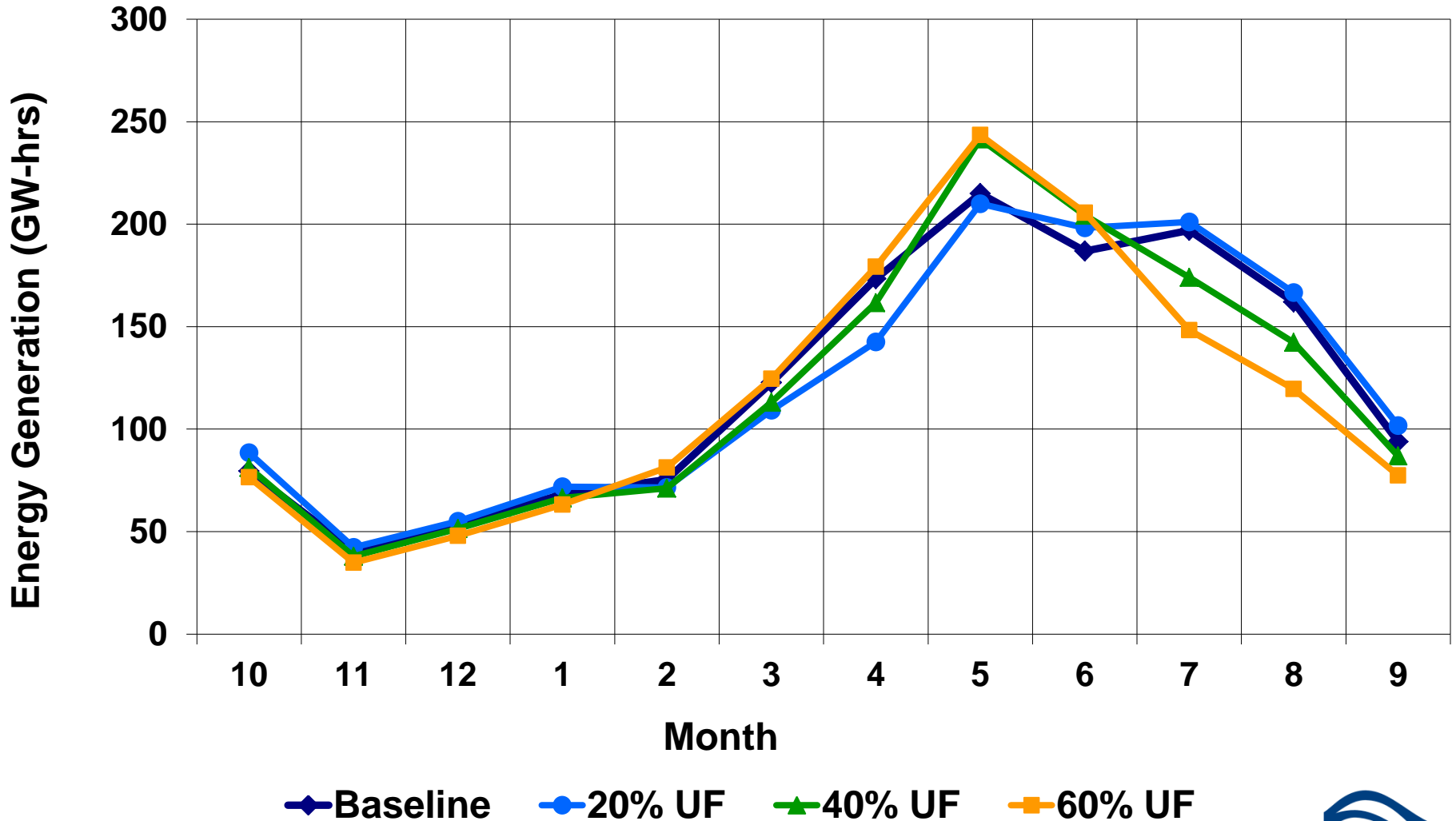
# Monthly Hydropower Generation

- WSE model provides reservoir releases/elevations and diversions.
- Power equation used for major reservoir and in-stream facilities
- Percentage of capacity for off-stream facilities equal to surface water diversions
- Monthly hydropower estimated for three alternatives and compared to baseline.

# Average Annual Baseline Hydropower Generation and Difference from Baseline

Alternative	Stanislaus (GWh)	Tuolumne (GWh)	Merced (GWh)	Project Area (GWh)
<b>Baseline</b>	<b>437</b>	<b>628</b>	<b>403</b>	<b>1,467</b>
20% UF	-10	0	0	-10
40% UF	-19	-9	-9	-37
60% UF	-31	-18	-18	-66
Alternative	(%)	(%)	(%)	(%)
20% UF	-2%	0%	0%	-1%
40% UF	-4%	-2%	-2%	-3%
60% UF	-7%	-4%	-5%	-6%
<b>GWh = gigawatt hours</b>				

# Average Monthly Generation

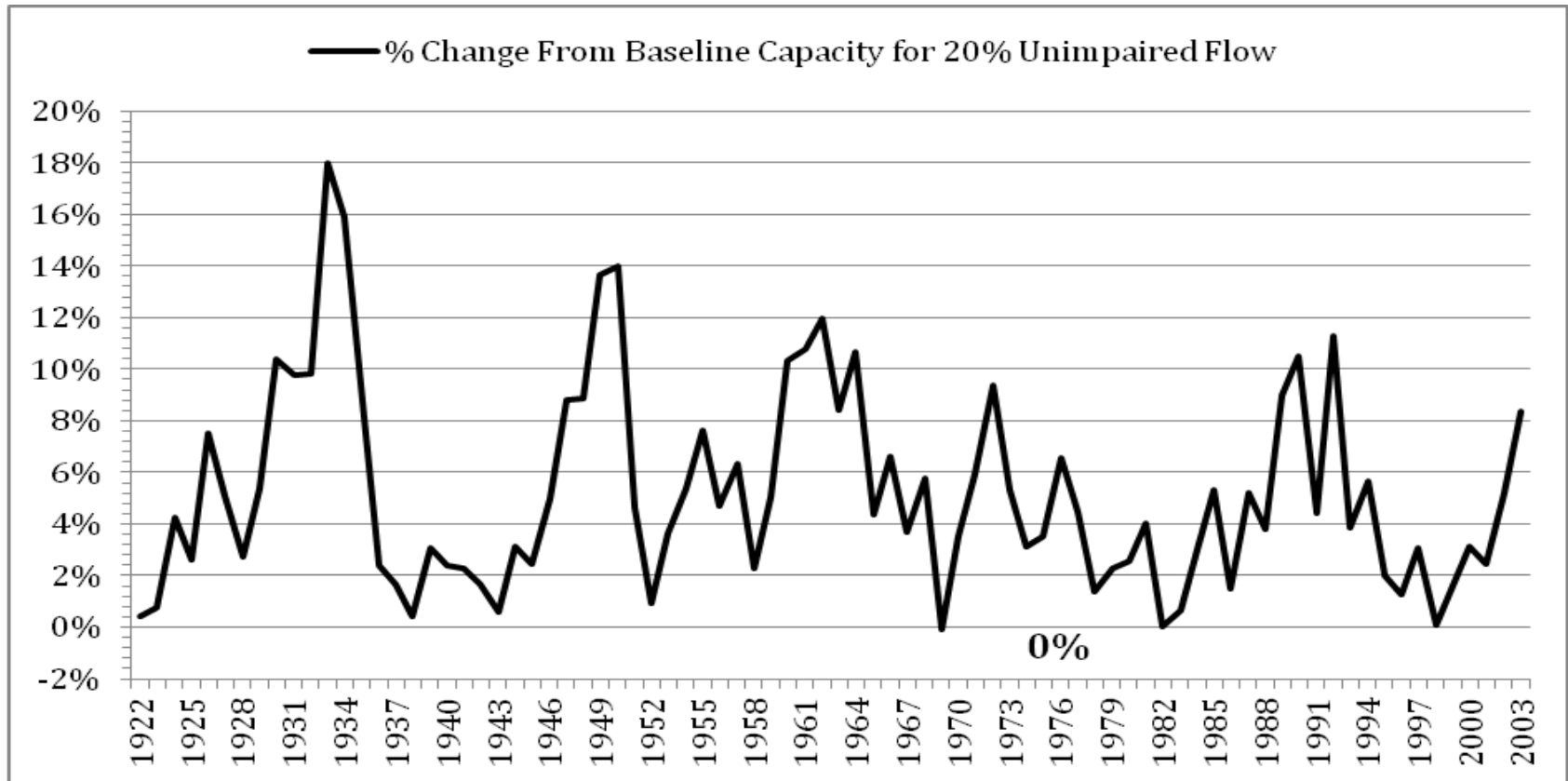




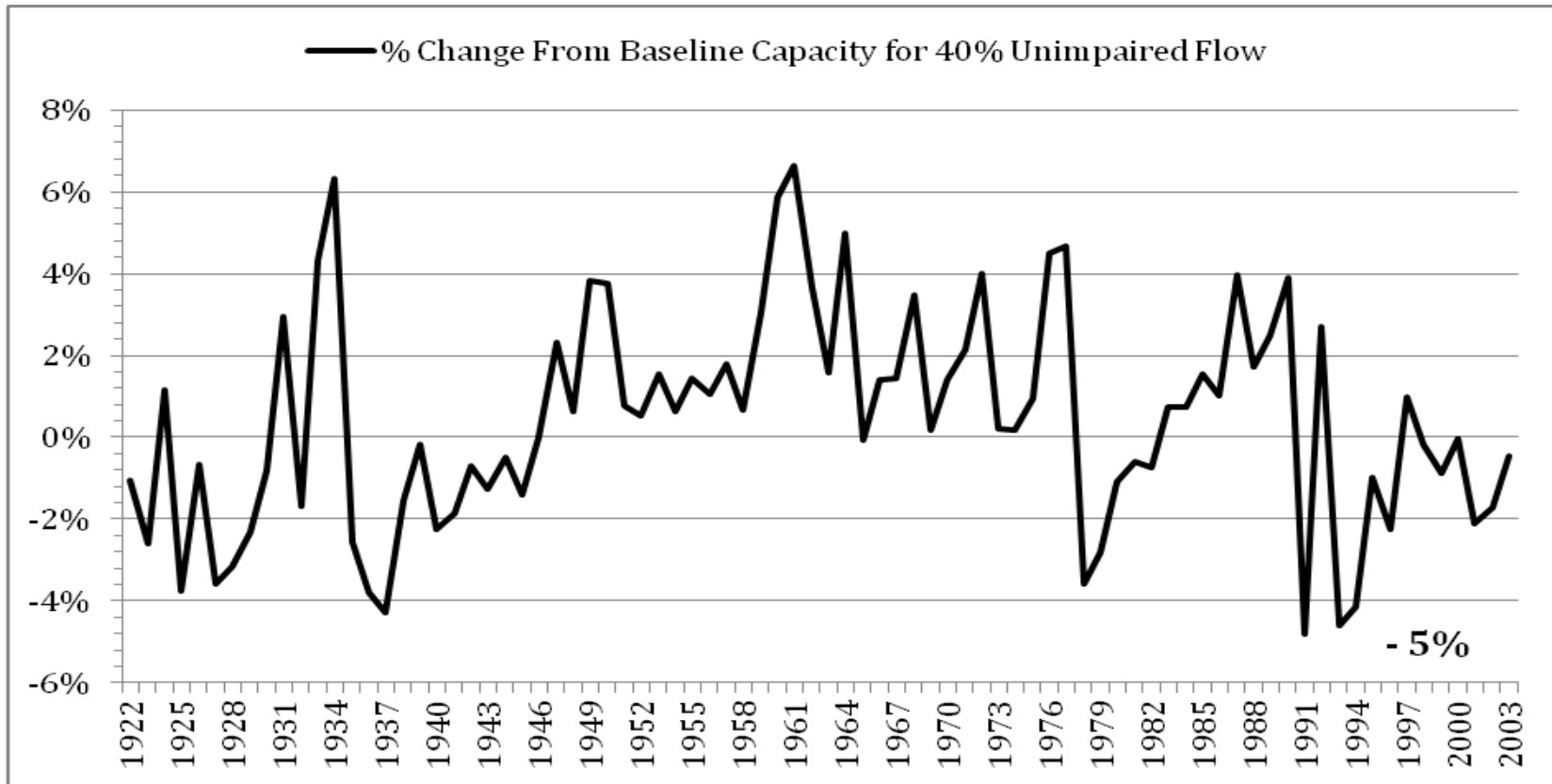
# Electric Grid Reliability

- Power flow analysis using General Electric - Positive Sequence Load Flow Model
- Lowest July reservoir storage level from WSE model with full rated flow.
- Calculate hydropower capacity for this worst-case month
- Used latest 2011 heavy summer demand model from WECC.

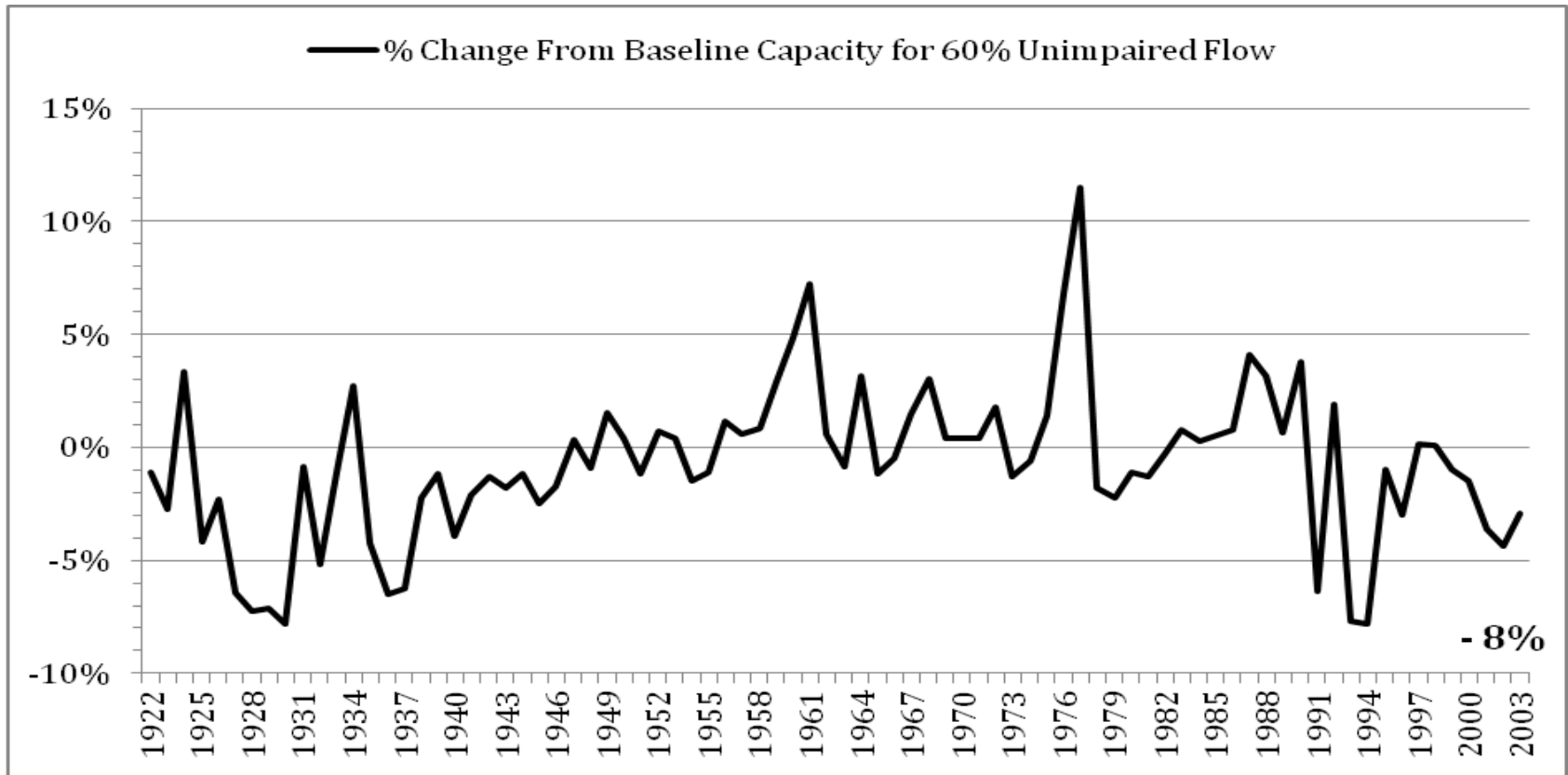
# Change in July Capacity (20% Unimpaired Flow)



# Change in July Capacity (40% Unimpaired Flow)



# Change in July Capacity (60% Unimpaired Flow)



# Scenarios Modeled

Case Description	Output of Hydro Units <sup>a</sup>	Normal Conditions	Contingency Conditions
Base Case / 20% Unimpaired	Normal	X	X
40% Unimpaired	Reduced by 5 %	X	X
60% Unimpaired	Reduced by 8 %	X	X

<sup>a</sup> Units refer to New Melones, New Exchequer, and New Don Pedro Facilities

# Grid Reliability Modeling Results

With the worst-case July capacity reductions under peak summer demand assumptions:

- The 60% flow alternative had a minor, but easily mitigated violation under a transmission line contingency
- All contingency scenarios and all other alternatives experienced no limit violations

# Questions?