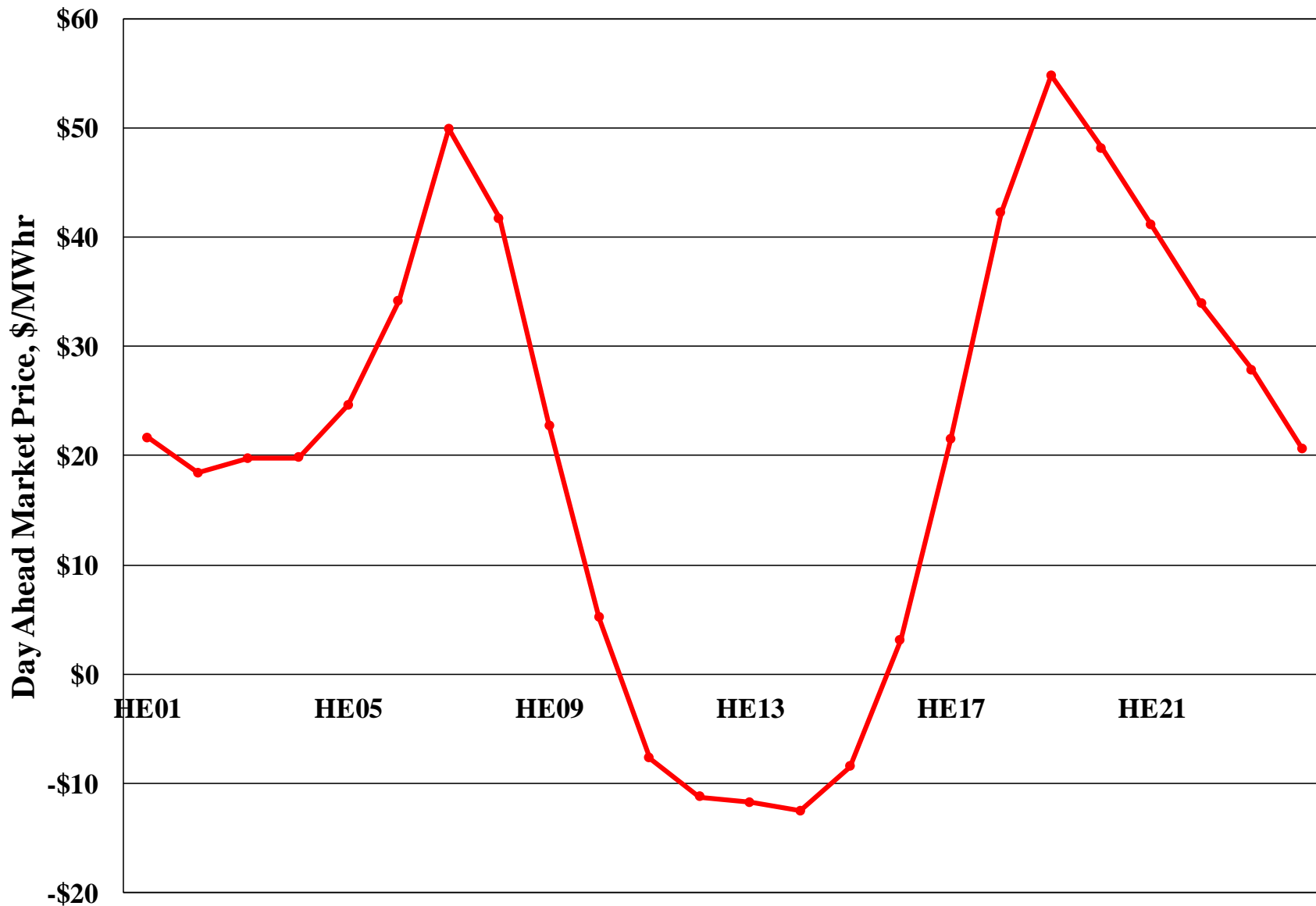# Review of Load Curtailments at the GEO Facility

California ISO Day Ahead Market Prices

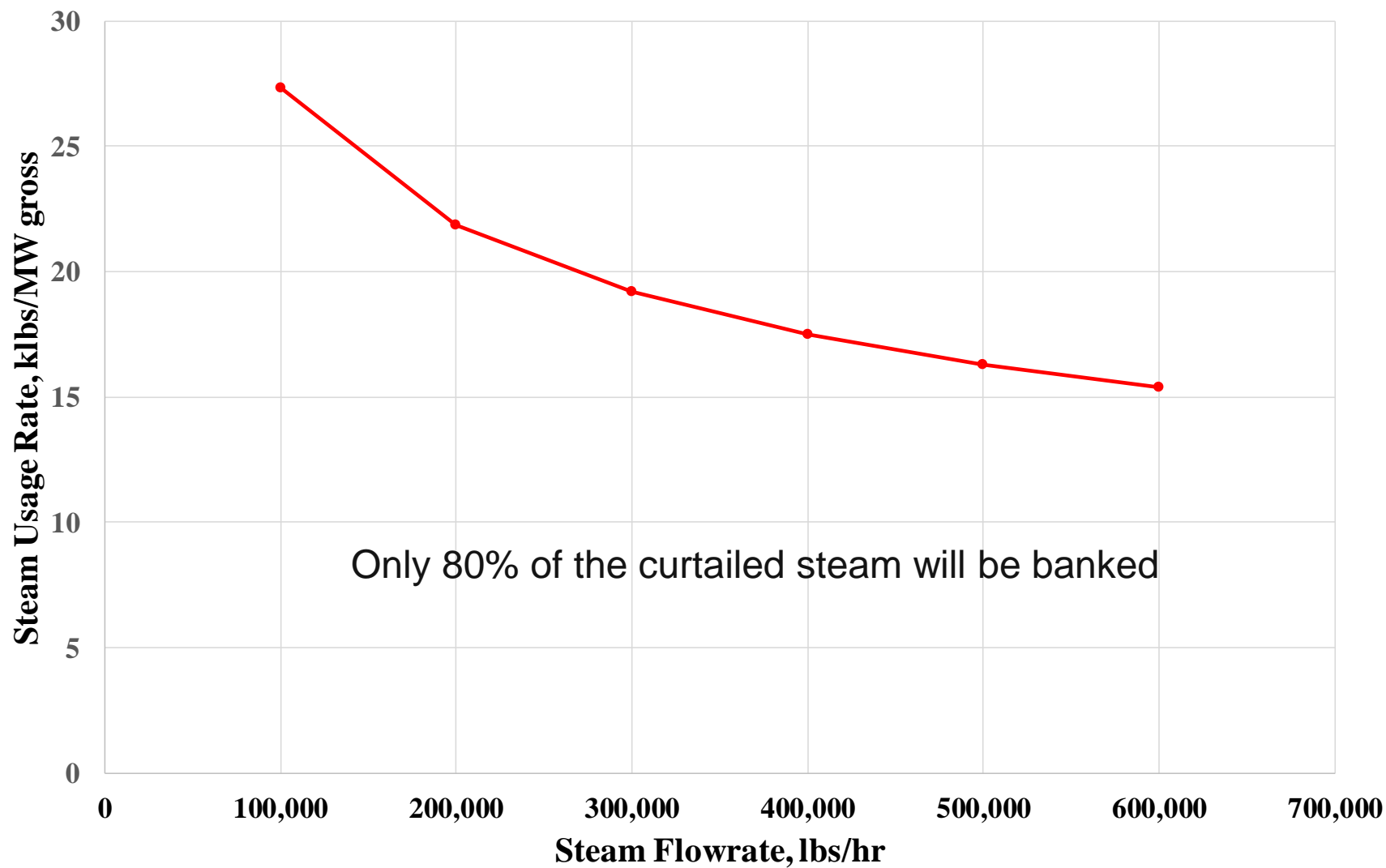# Considerations for GEO Load Curtailments Advantages

- **Higher revenue – Avoid negative pricing**

- **Preserve steam for future use when Day Ahead Market prices are higher**
  - **No significant puff of the reservoir is expected when returning from curtailment period**

- **Expected to curtail only during hydro run off**
  ~ 3 to 4 months
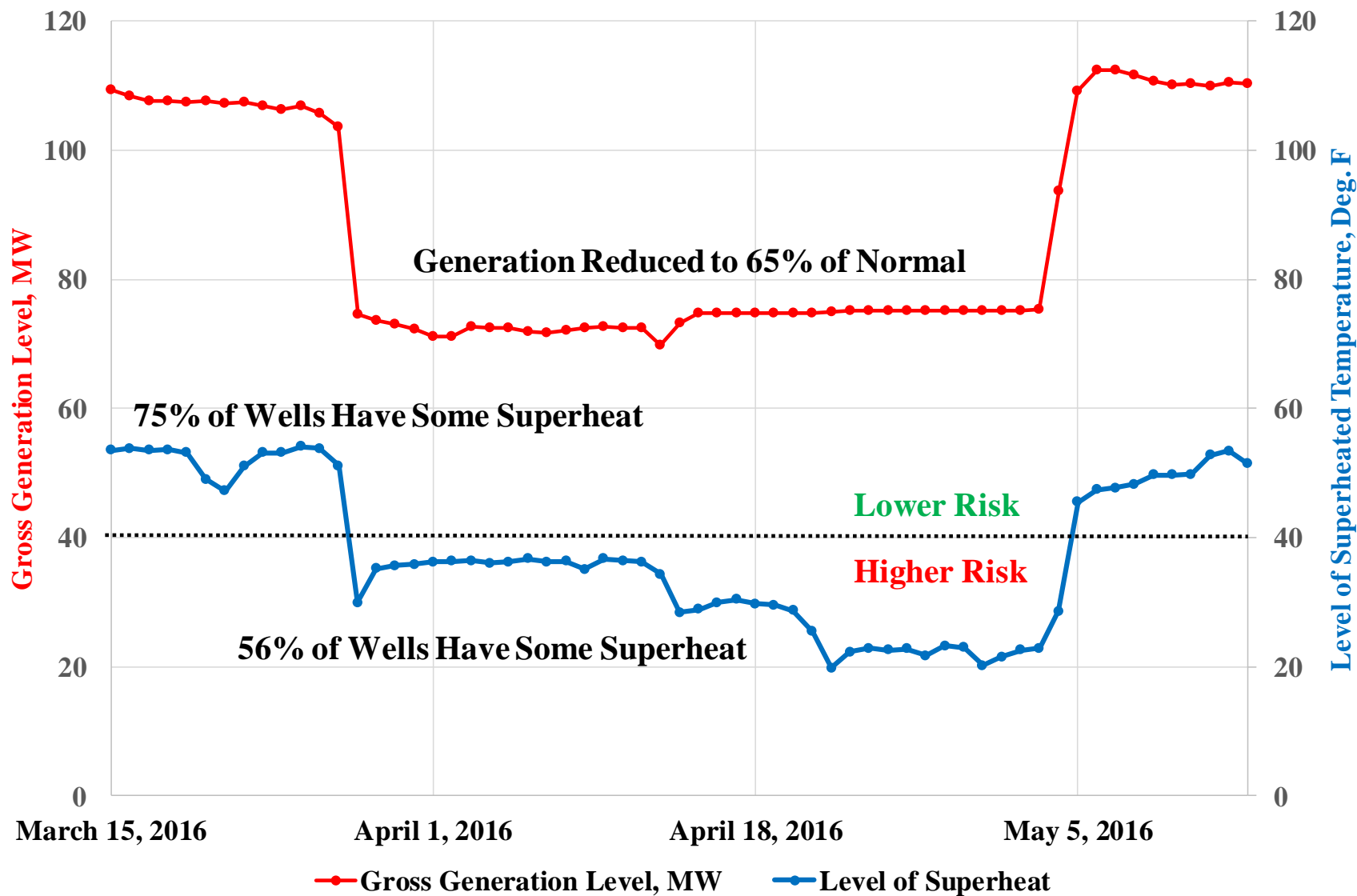
Considerations for GEO Load Curtailments Disadvantages

- **No immediate return for curtailing production**
  - **Loss of REC's**

- **Some steam may be captured by nearby operator**
- **Turbine is less efficient at reduced loads**

- **Plant Equipment**
  - **Potential incidental Seasonal O&M costs ~ $10,000 to $20,000**
    - **Increased water disposal costs**
    - **Increased abatement costs**
    - **Increased manpower costs**

- **Steam Field**
  - **Increased workover risk to steam wells**
  - **Increased level of steam condensate in pipelines**

NORTHERN CALIFORNIA POWER AGENCY

NCPA Geo Facility Gross Generation and Superheat Levels
March 15 - May 15, 2016

Generation Reduced to 65% of Normal

75% of Wells Have Some Superheat

Lower Risk

Higher Risk

56% of Wells Have Some Superheat

Gross Generation Level, MW   Level of Superheat

Considerations for GEO Load Curtailments

- **Mid-1990's Daily Curtailment**
  - **Daily cycling of plants during hydro run off season to 30% to 50% of capacity**
  - **Probability of well bridging after curtailing following hydro run off season ~ 2%**

- **Competent rock but risk of 1 to 2 wells bridging off**

- **Estimated current cost of well workover ~$3.5 million**

- **Premium for potential well damage $5.00/mwh (breakeven point)**
  - **(2% x $3.5 million)/ (45 mw curtailment x 4 hours/day x 90 days)**

- **Premium for increased O&M $1.25/mwh**
  - **($20,000 increased O&M / (45 mw curtailment x 4 hours/day x 90 days)**

Considerations for GEO Load Curtailments

- **Recommend 45 MW Max. Curtailment**

  - **Curtailment to be spread over three units, approximately 50% of normal generation**
    - **May need to adjust the curtailment level depending upon the steam field response**

- **Curtailment duration**

  - **Only Cycle when the daily prices are expected to be at the negative price above for 4 hours or more**

  - **Limit cycling to once per day**

Fiscal Impact of Curtailing 45 MW

Energy Price $/MWhr	Assumed REC Value $/MWhr	Royalty Cost $/MWhr	O&M Costs Cost $/MWhr	Well Work Over Risk Cost $/MWhr	Net Cost of Curtailment Cost $/MWhr	MW Curtailed	Fiscal Impact per MWhr	4 hr Daily Curtailment for 45 MWhr $/Day	Seasonal Value 90 Days $
(5.00)	($15)	$2.18	($1.25)	($5.00)	($19.07)	45	($14.07)	($2,533)	($227,934)
(19.07)	($15)	$2.18	($1.25)	($5.00)	($19.07)	45	$0.00	$0	$0
(24.07)	($15)	$2.18	($1.25)	($5.00)	($19.07)	45	$5.00	$900	$81,000
(29.07)	($15)	$2.18	($1.25)	($5.00)	($19.07)	46	$10.00	$1,840	$165,600

Three methods to Curtail Geysers Output

- **Day Ahead Scheduling/bidding**
  - **Self schedule minimum load and bid agreed to negative price for remainder of generation**
    - **Receive Day Ahead energy price for final schedule**
    - **Need to guess at forward prices self schedule minimum load**

- ***Future Possible Options***
  - **Fifteen minute market (FMM) (Gain experience with curtailment and resolve compliance equation)**
    - **Self schedule plant for full output**
      - **Receive Day Ahead Energy Price for full output**
    - **Bid negative pricing into FMM**
      - **Buy or sell changes in output at FMM clearing price**

  - **Regulation Service (Gain experience with curtailment-plant not certified today)**
    - **Bid/self schedule plant into market**
    - **Bid regulation up/down into market**
      - **Receive "capacity payment" for regulation service**
      - **Buy or sell regulation energy at real time market price**

Recommendations

- **Recommend that the GEO facility not be curtailed unless**
  - **Power prices are a negative price of $19.07/MWhr or lower**
    - **(breakeven point covering risk exposure of well damage, increased O&M, and loss or REC).**
  - **Recommend additional margin be added to the minimum price to ensure a positive benefit (ie $5 to 10/mwh resulting in a negative price of $24.07- 29.07/mwh used for curtailment)**

- **Curtailment level**
  - **Maximum of 45 MW**
    - **The amount of curtailment may need to be adjusted based upon steam field response**
  - **Only Cycle when the daily prices are expected to be at the negative price above for 4 hours or more**
  - **Limit cycling to once per day**