Defining Loss-of-Load Probability For the Northwest Power Supply

Resource Adequacy
Technical Subcommittee Meeting
October 7, 2005

Purpose

- Review how the current LOLP is calculated
- Assess the relative cost of various LOLP targets
- Examine the relationship between LOLP and the curtailment threshold
- Defining a “significant” curtailment event
- Discuss alternative ways to calculate LOLP
- Why LOLP is a reasonable metric

Review how the current LOLP is calculated

GENESYS

Monte Carlo Simulation Program

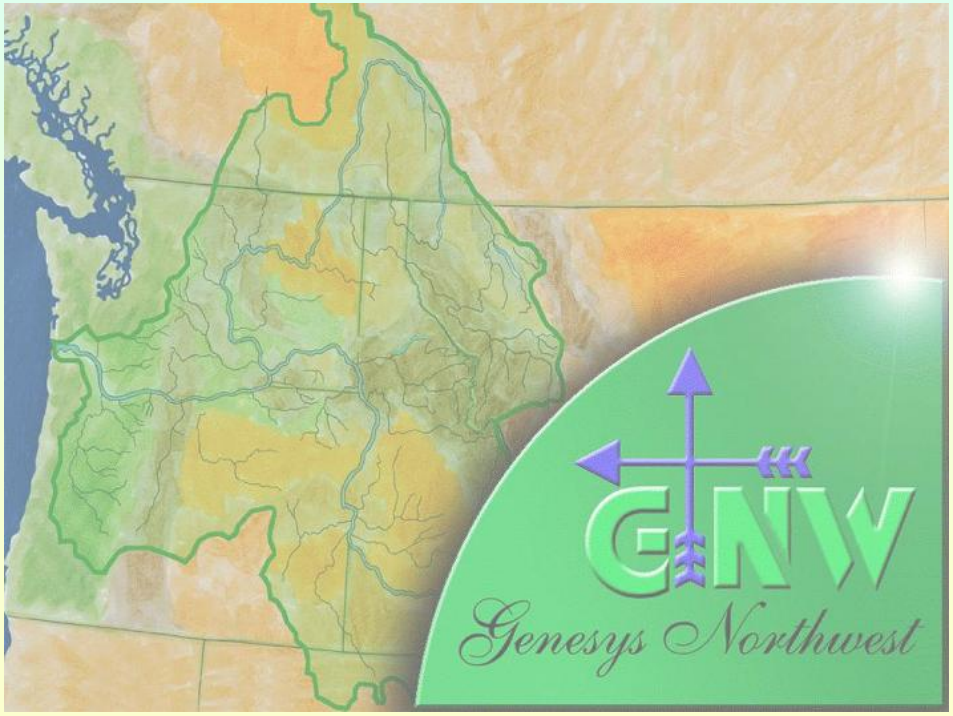
Detailed NW Hydro Simulation

Hourly Economic Dispatch

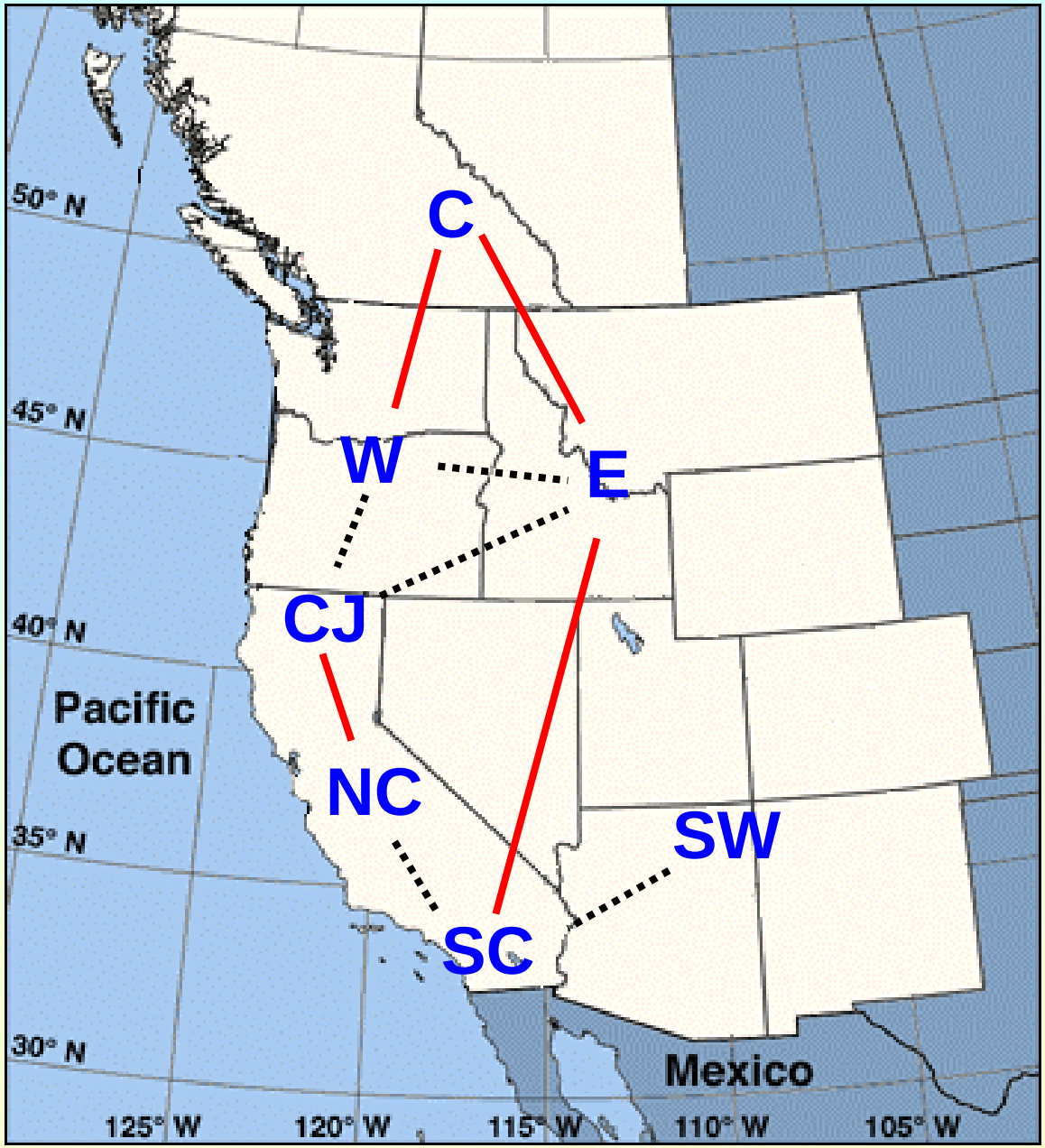
Inter-regional Transmission Capacity
(but not forced outages)

Random Variables:

1. Water Conditions
2. Temperature/Loads
3. Thermal Resource
   Forced Outage



www.nwcouncil.org/genesys



Transmission Modeled in GENESYS

NW region includes:
East (E)
West (W)
Captain Jack (CJ)

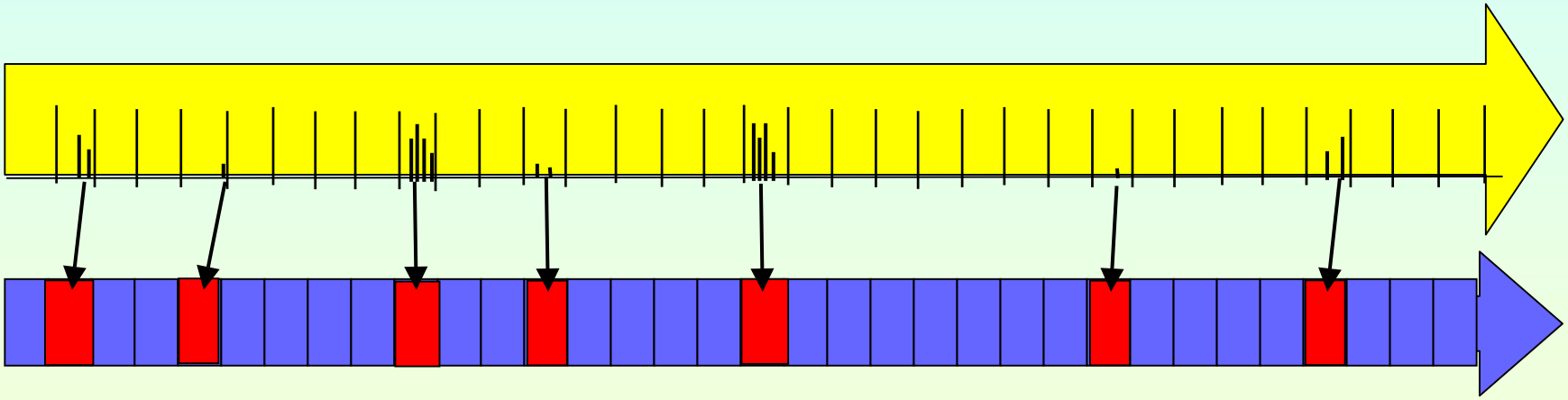
Solid lines indicate transmission into and out of the region

What do we Count?

- Ideally, we count “significant” events (those that we do not want to occur).
- But, we have not yet defined what a “significant” event is.
- For now, calculate the energy of curtailing 1,200 mw for one day (28,800 mw-hours).
- This translates into 10 mw-seasons (across four months).

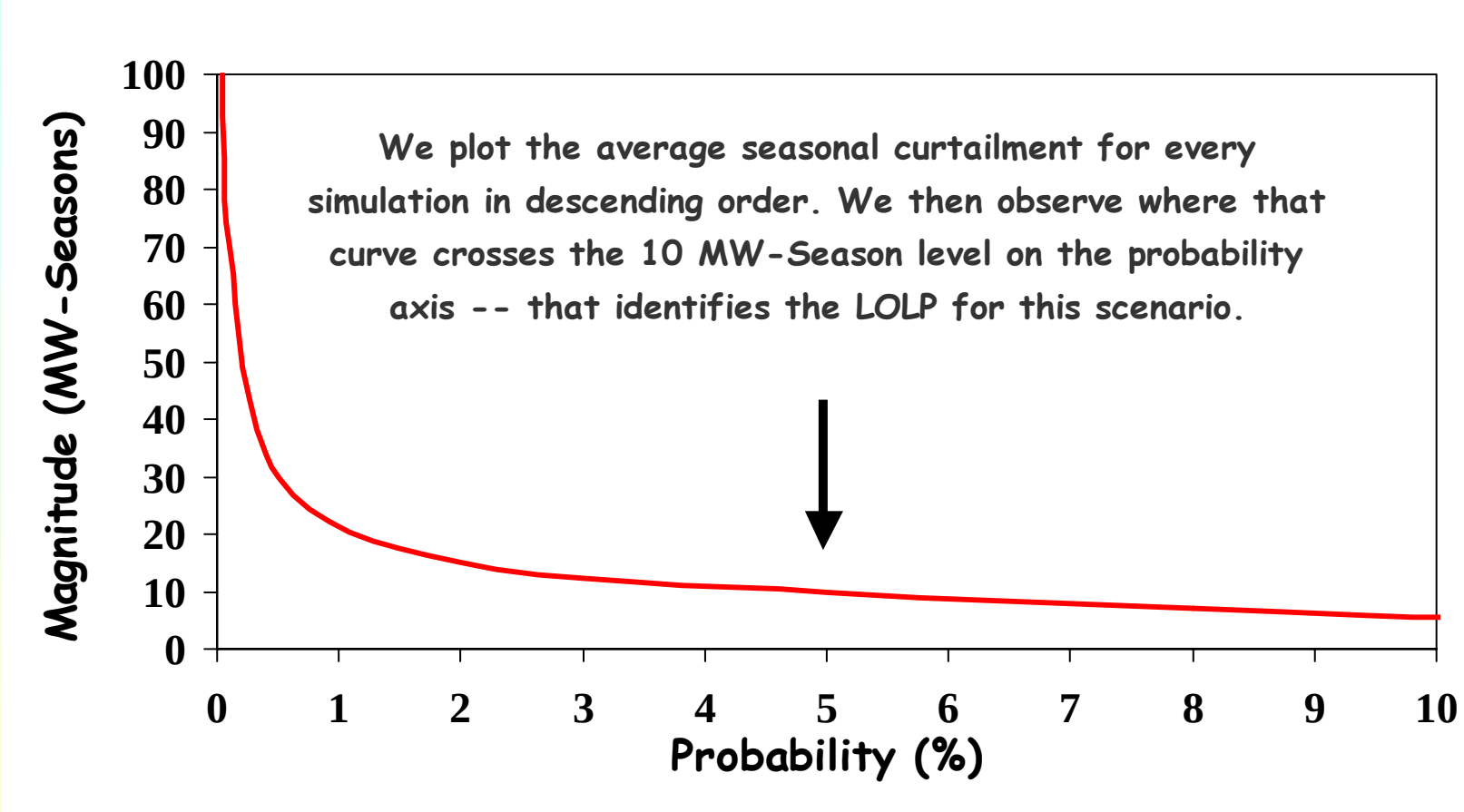
Loss of Load Probability

Simulated 300 winters (December through March)



Out of 300 winters, 15 had an average curtailment greater than 10 MW-seasons, which means that the
Winter Loss of Load Probability (LOLP) = 15/300 = 5 percent

Loss of Load Probability



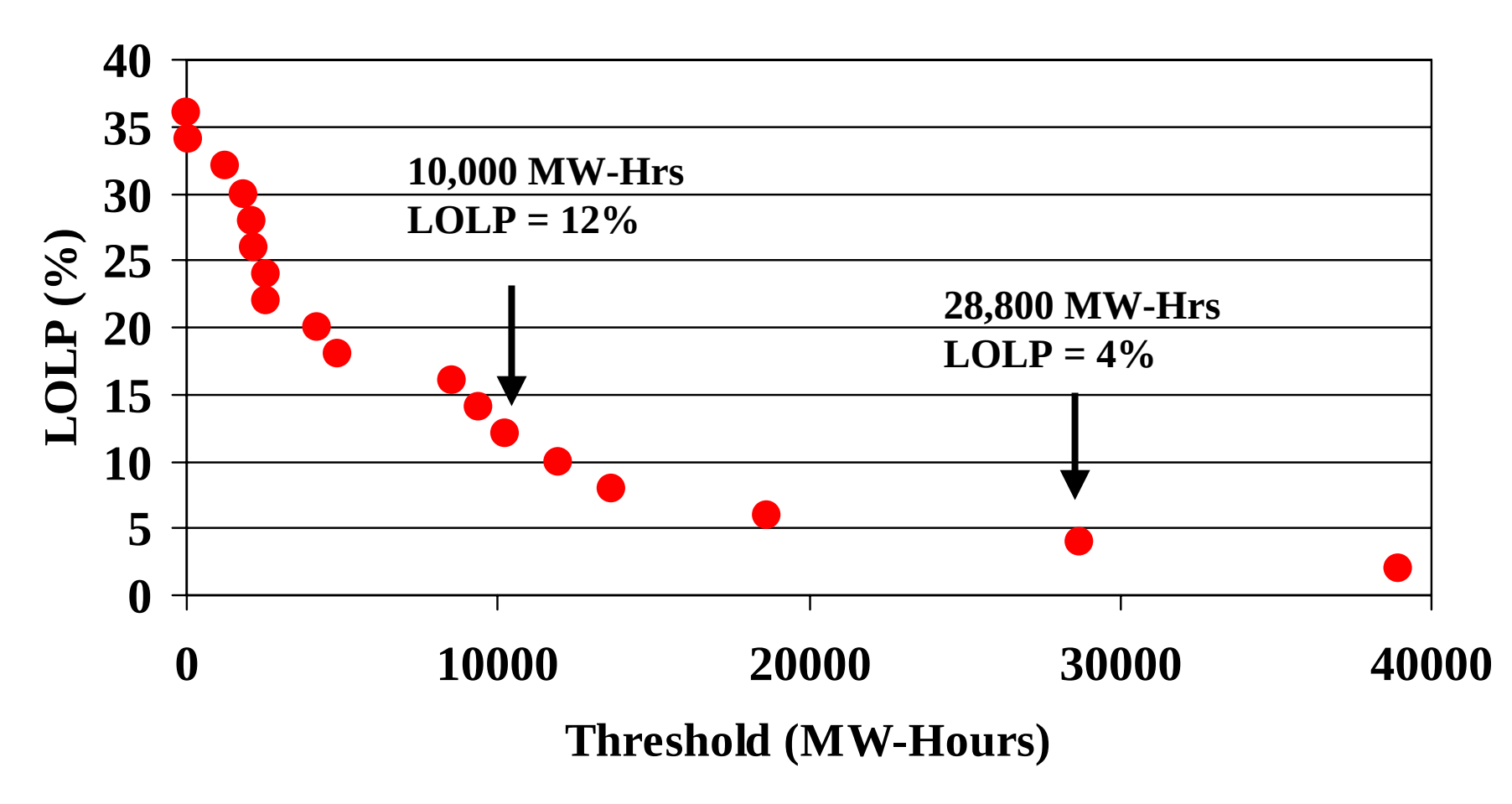
Assess the relative cost of various LOLP targets

Cost of LOLP Targets

- For each 1,000 aMW decrease in load, the LOLP drops from 7 to 19 percent depending on conditions
- The cost of serving 1,000 aMW with a new resource is about $350 million per year
- The cost of decreasing LOLP by one percent ranges from about $18 to $50 million per year
- More analysis needed

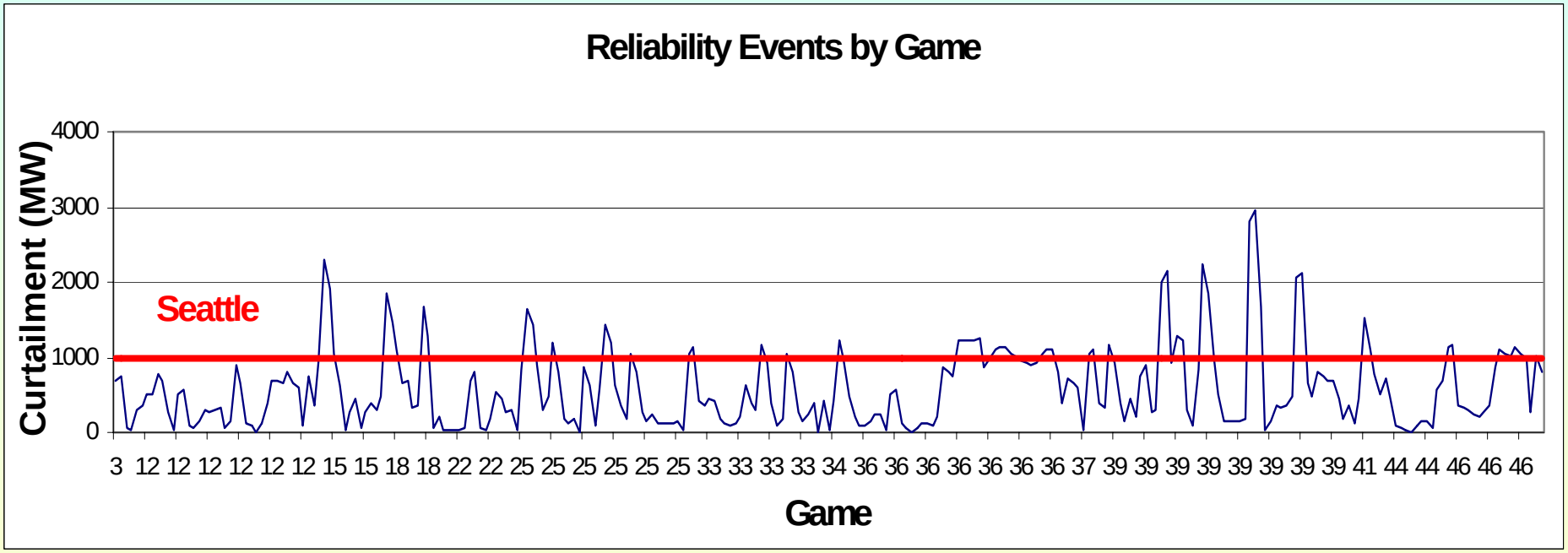
Examine the relationship between LOLP and the curtailment threshold

LOLP vs. Threshold



Defining a “significant” curtailment event

Curtailment Events



Study Statistics

Number of Simulations (Games)	50
Hours in the Dec-Mar period	2,904
Total number of hours simulated	145,200
Number of games with at least one hour of curtailment	18
Number of curtailment hours (over all games)	275
Number of curtailment events	83
Average magnitude per event	1,953 MW-hrs
Average duration per event	3.4 hours
Average number of events per game with curtailments	4.6

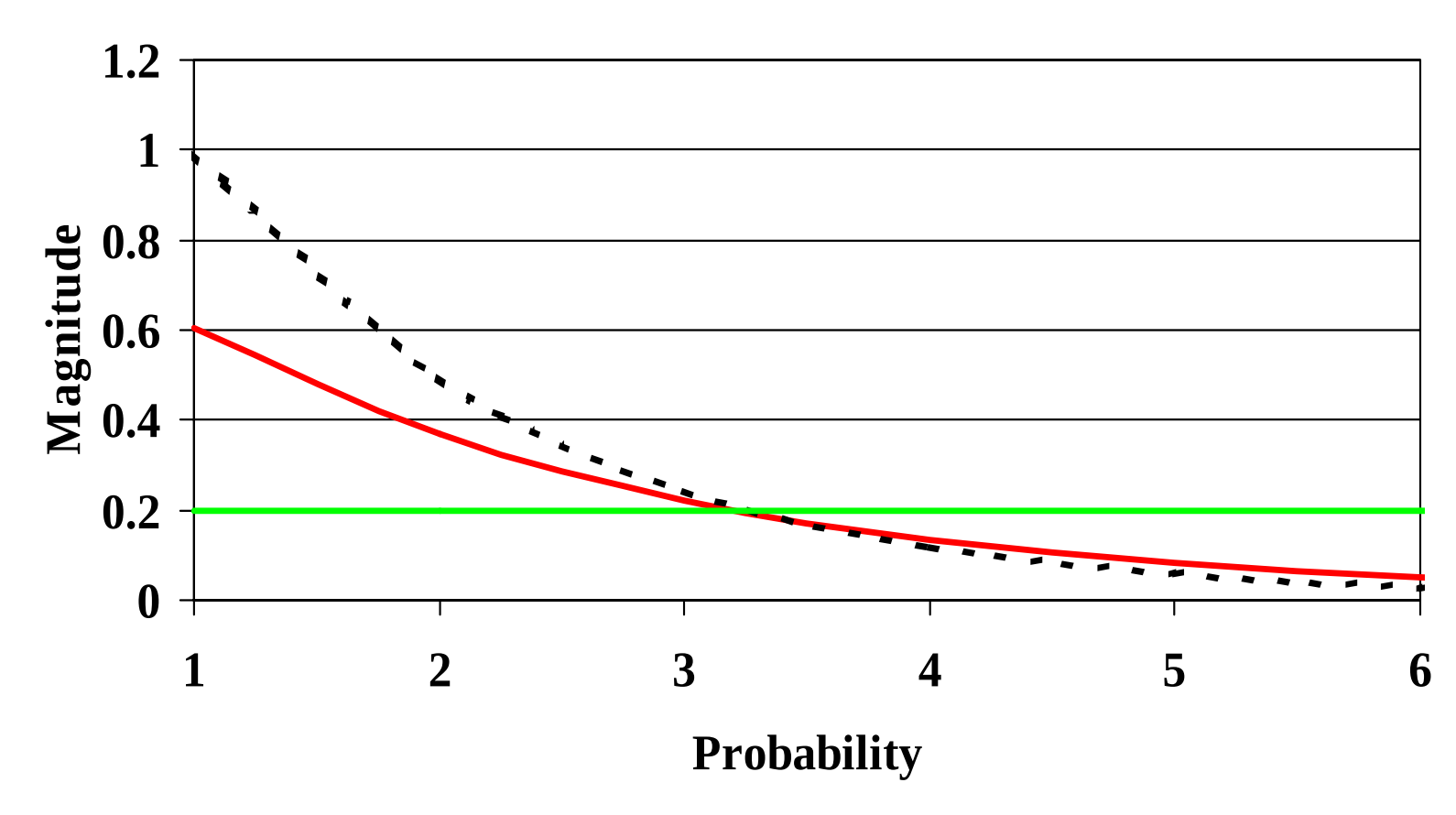
Alternative ways to calculate LOLP

LOLP Type Statistics

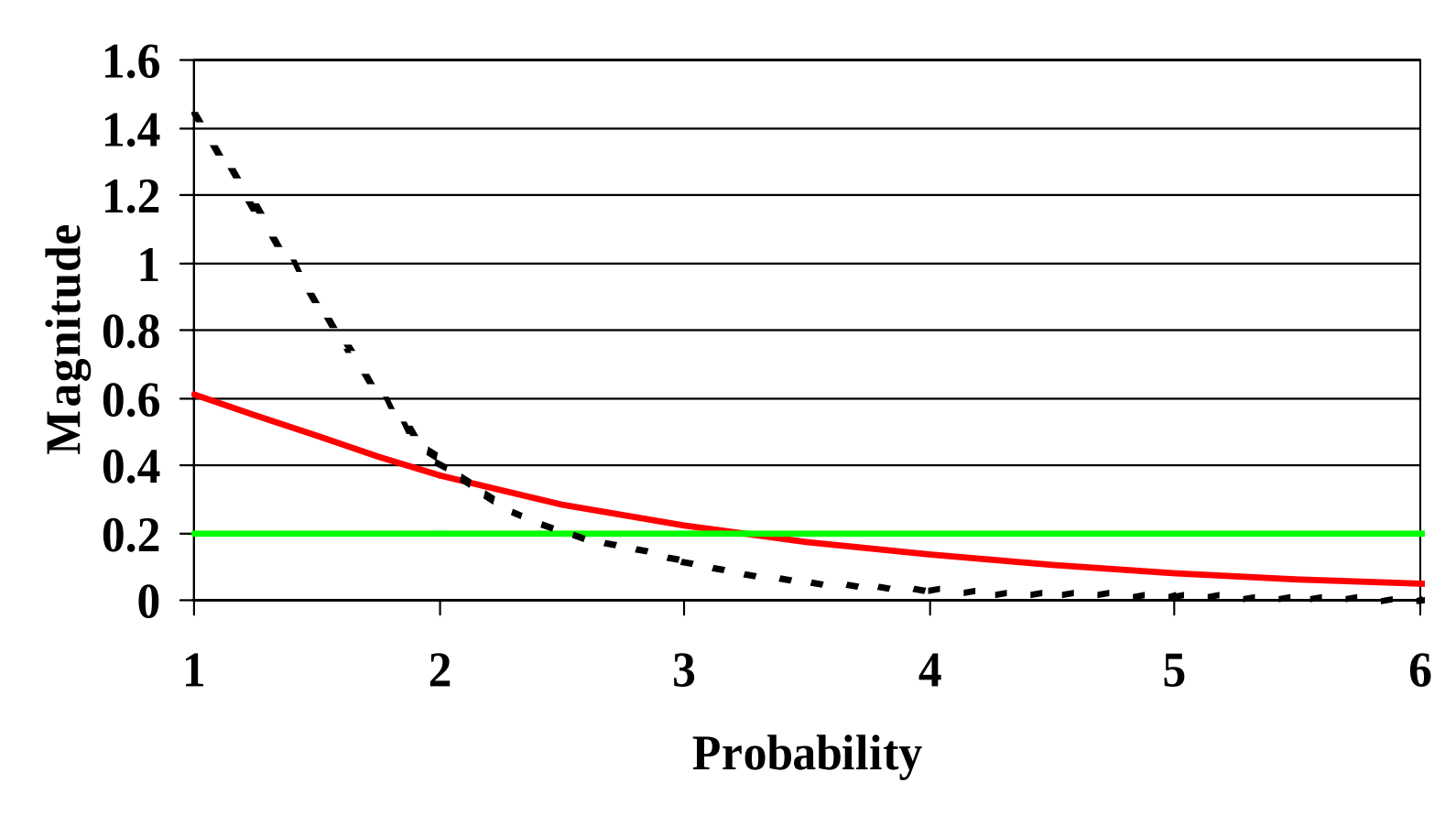
Types of events	**No. of Games**	**LOLP (%)**
At least 1 hour of curtailment	18	36
Total curtailment > 28,800 mw-hrs	2	4
Total curtailment > 10,000 mw-hrs	6	12
At least one event > 4 hours	13	26
At least one event > 4,000 mw-hrs	9	18
At least one event > 4-hour & > 4,000 mw-hrs	5	10
At least five hours with curtailment > 1,000 mw	5	10
At least ten hours with curtailment > 1,000 mw	2	4
At least one hour with curtailment > 1,000 mw	11	22

Why LOLP is a reasonable metric

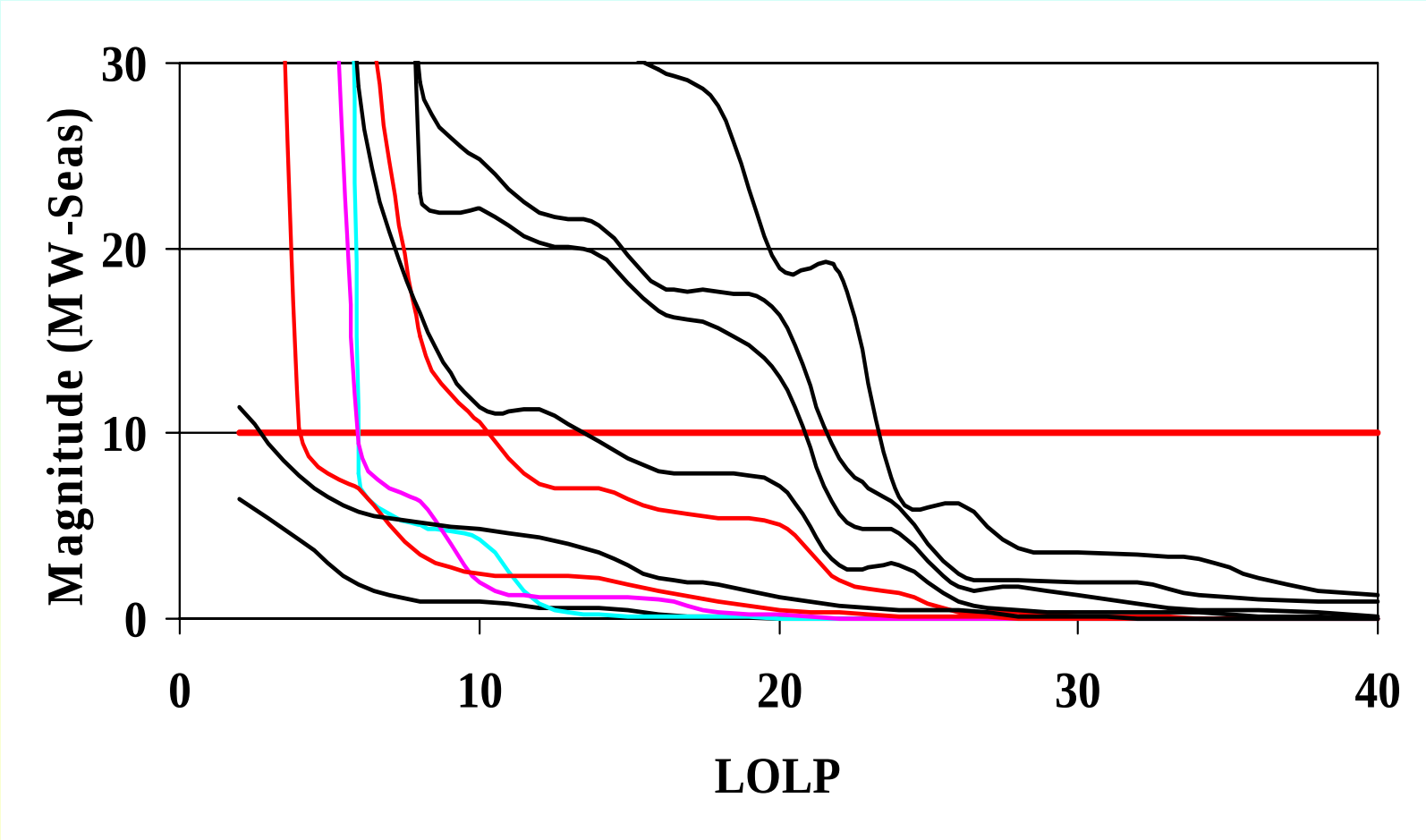
Potential Problem with LOLP
Same LOLP – Bigger Magnitude

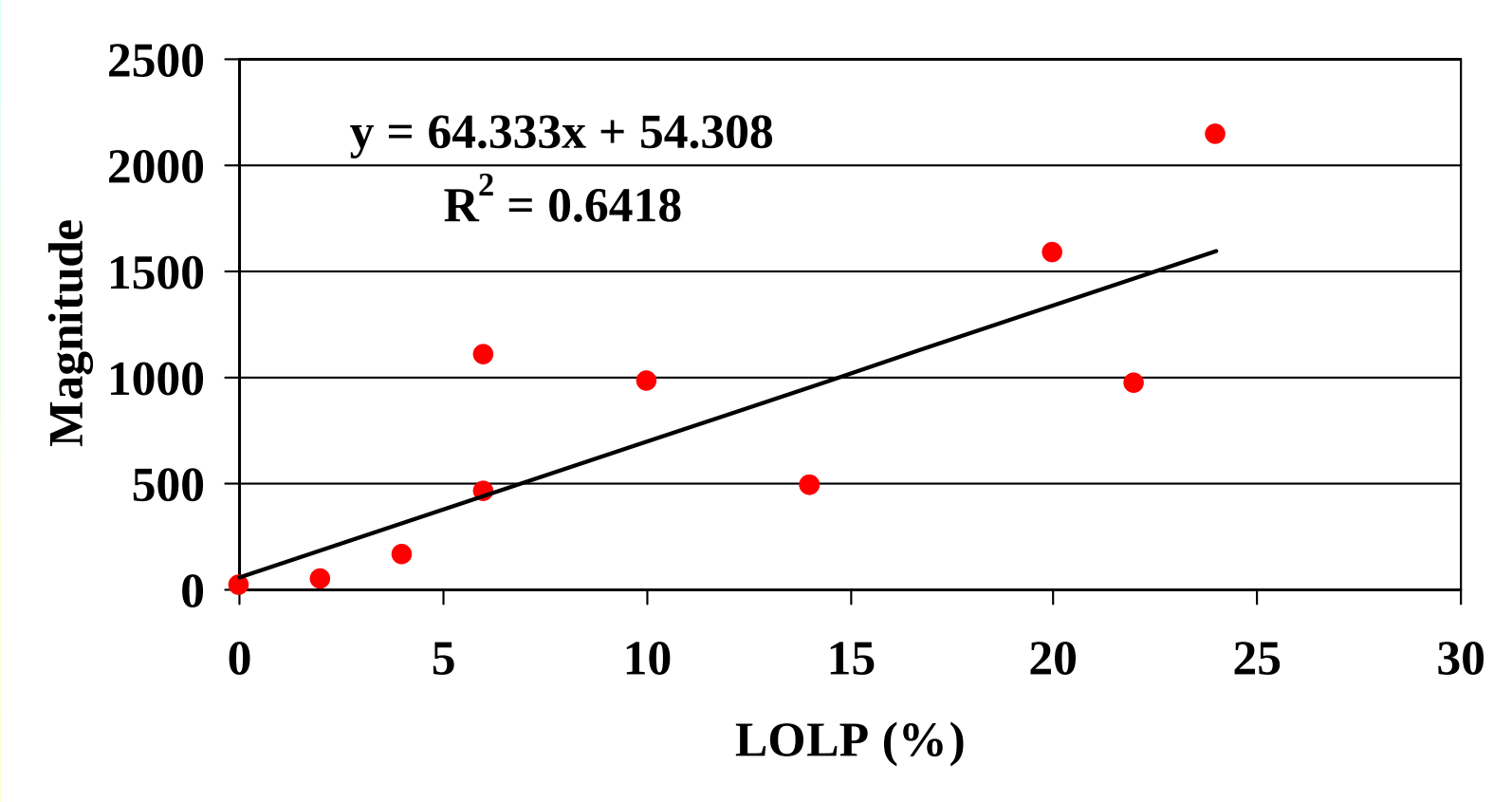


Potential Problem with LOLP
Lower LOLP – Bigger Magnitude



Are LOLP curves well behaved?



LOLP vs. Magnitude

(Generally, as the LOLP increases, so does the magnitude of the problem)