Fifth Power Plan

The Electricity Price Forecast and Resource Adequacy

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Resource adequacy – what & why

- Operating & standby reserves: Generation to meet short-term (hourly or daily) unplanned events impacting ability to meet load:
  - Short-term load excursions (heat wave or cold snap)
  - Unplanned generating plant outages or curtailments
  - Unplanned transmission outages or curtailments
  - Maintain transmission system stability
- Planning Reserves: generation to meet longer-term (months or years) unplanned events impacting ability to meet load:
  - Poor water conditions
  - Unanticipated load growth
  - Failure to complete new generation as scheduled

Measuring resource adequacy

- Customarily measured by the capacity or energy generation capability of the system:
  - Thermally-dominated (capacity-limited) systems:
    - Excess of capacity over peak load
  - Hydro-dominated (energy-limited) systems:
    - Load/resource balance under defined energy-limited condition

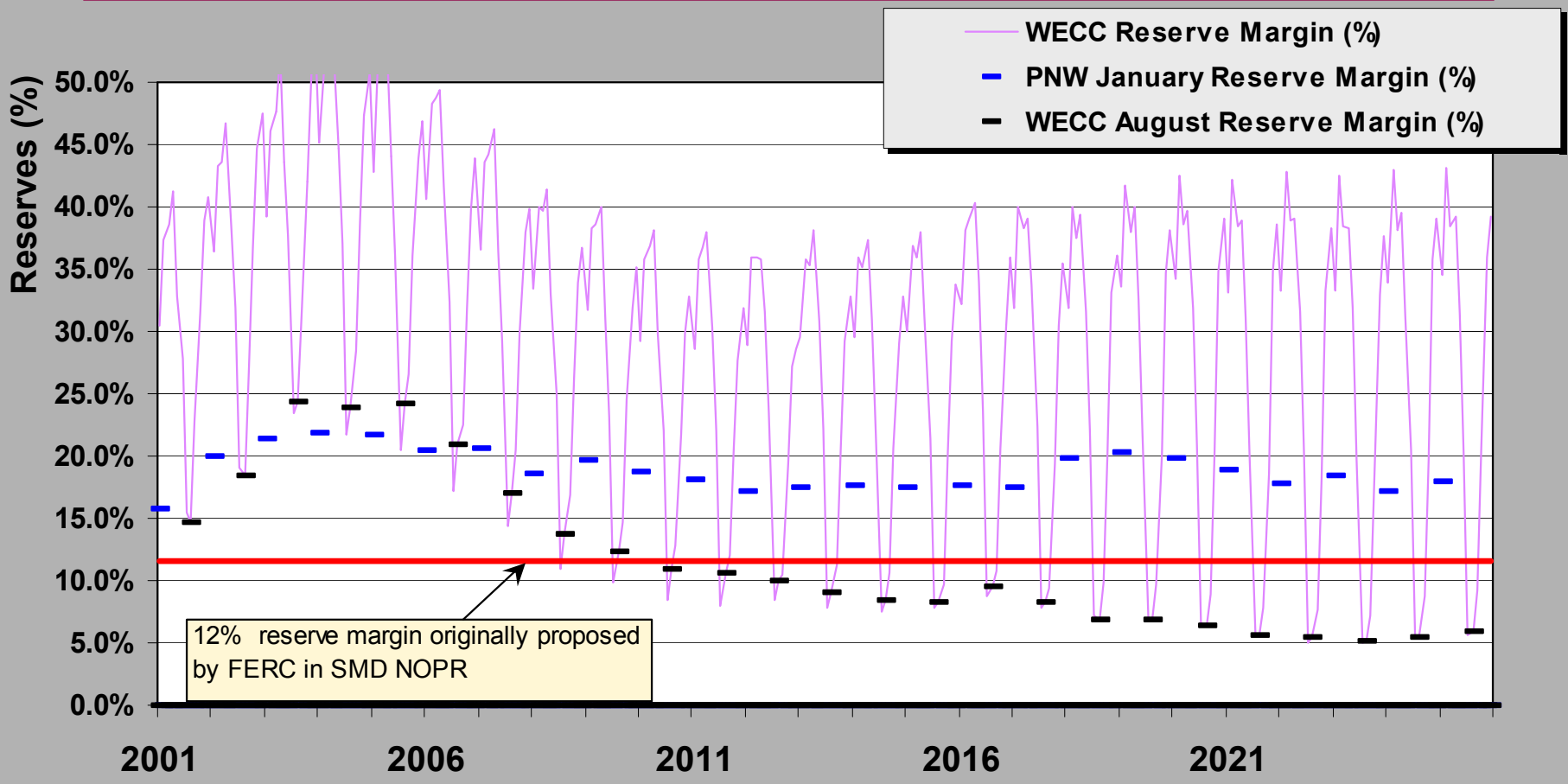
Some measures of resource adequacy

- 12% (minimum) reserve requirement proposed by FERC in July 2002 Standard Market design NOPR.
- System firm energy capability based on lowest historical 12 month hydro generation (Aug 1936 – July 1937)
- 5% LOLP – Loss of load probability. More a measure of short-term adequacy (i.e., adequacy of existing system)

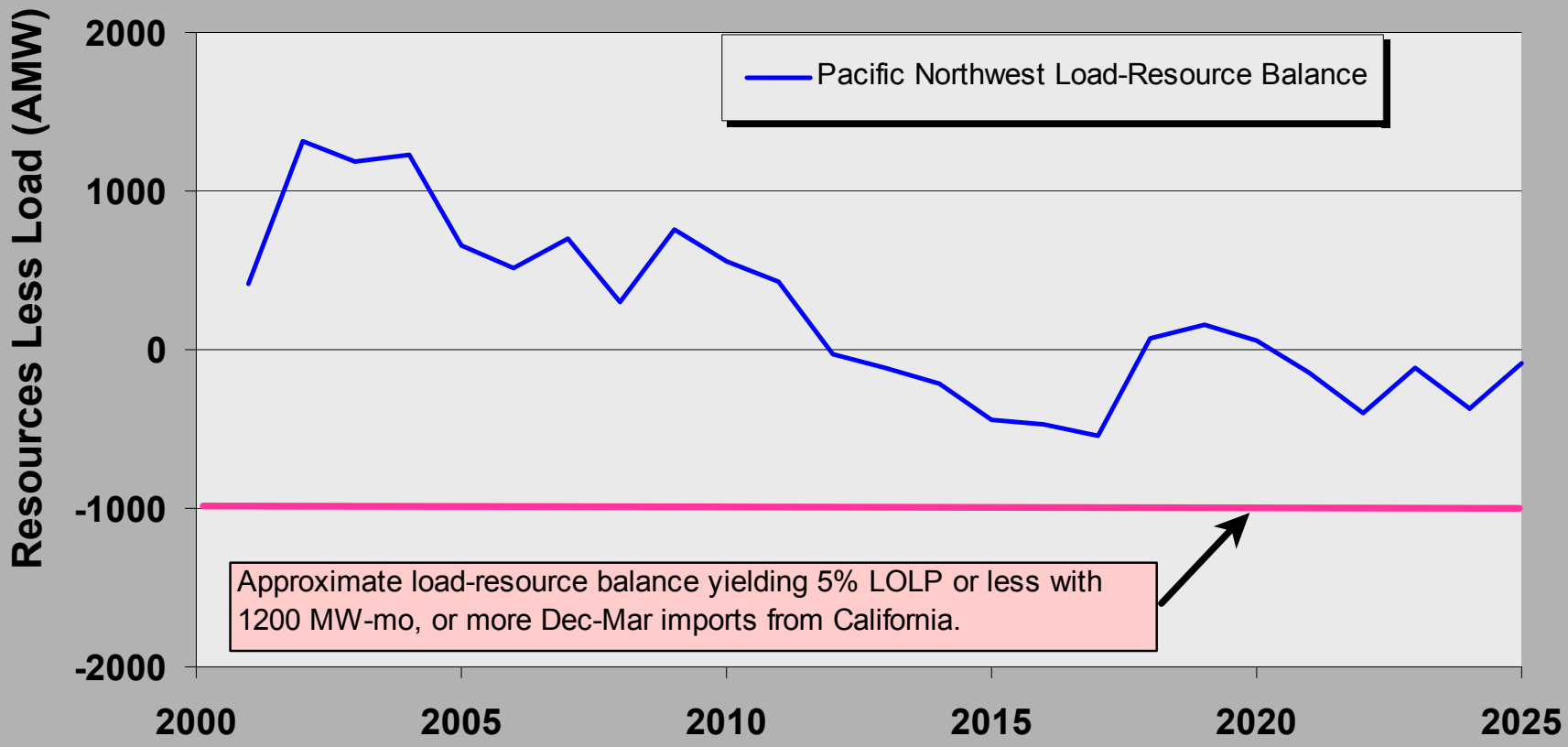
The base case price forecast resource mix may not include sufficient planning reserves

- While AURORA has a "knob" allowing desired operating reserve levels to be maintained:
  - AURORA capacity expansion runs see constant average water conditions, average loads and "as planned" resource development schedules.
  - AURORA has perfect foresight and optimizes resource additions and retirements to minimize costs.
- The resulting forecast of resource development tends toward a low level of reserves by conventional standards, probably inadequate to deal with long-term uncertainties – e.g., poor water years, failure to bring resources into service as planned, unanticipated load growth.

The base case electricity price forecast tends toward low reserves for WECC as a whole



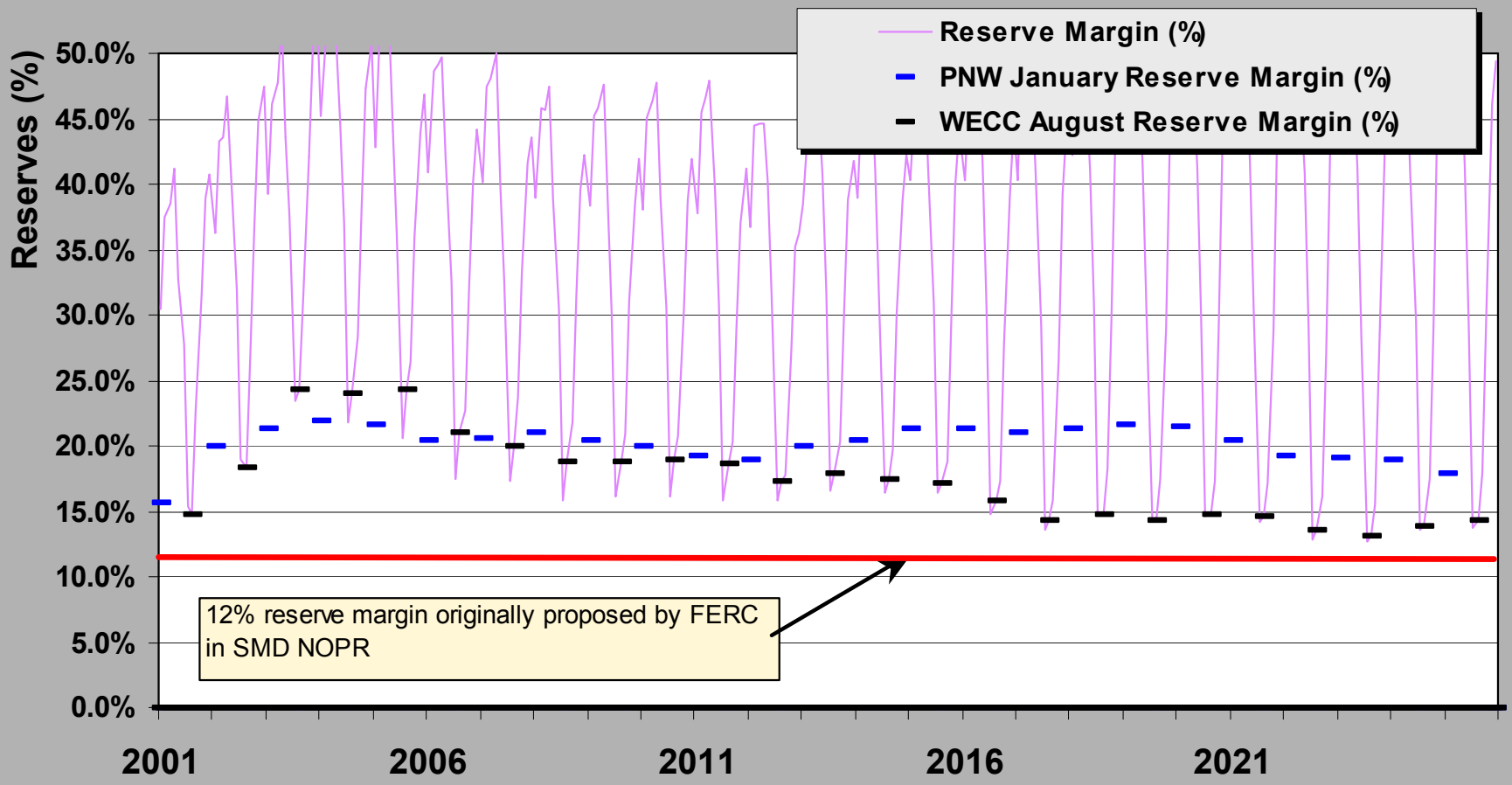
Northwest load-resource balance appears adequate in the base case price forecast



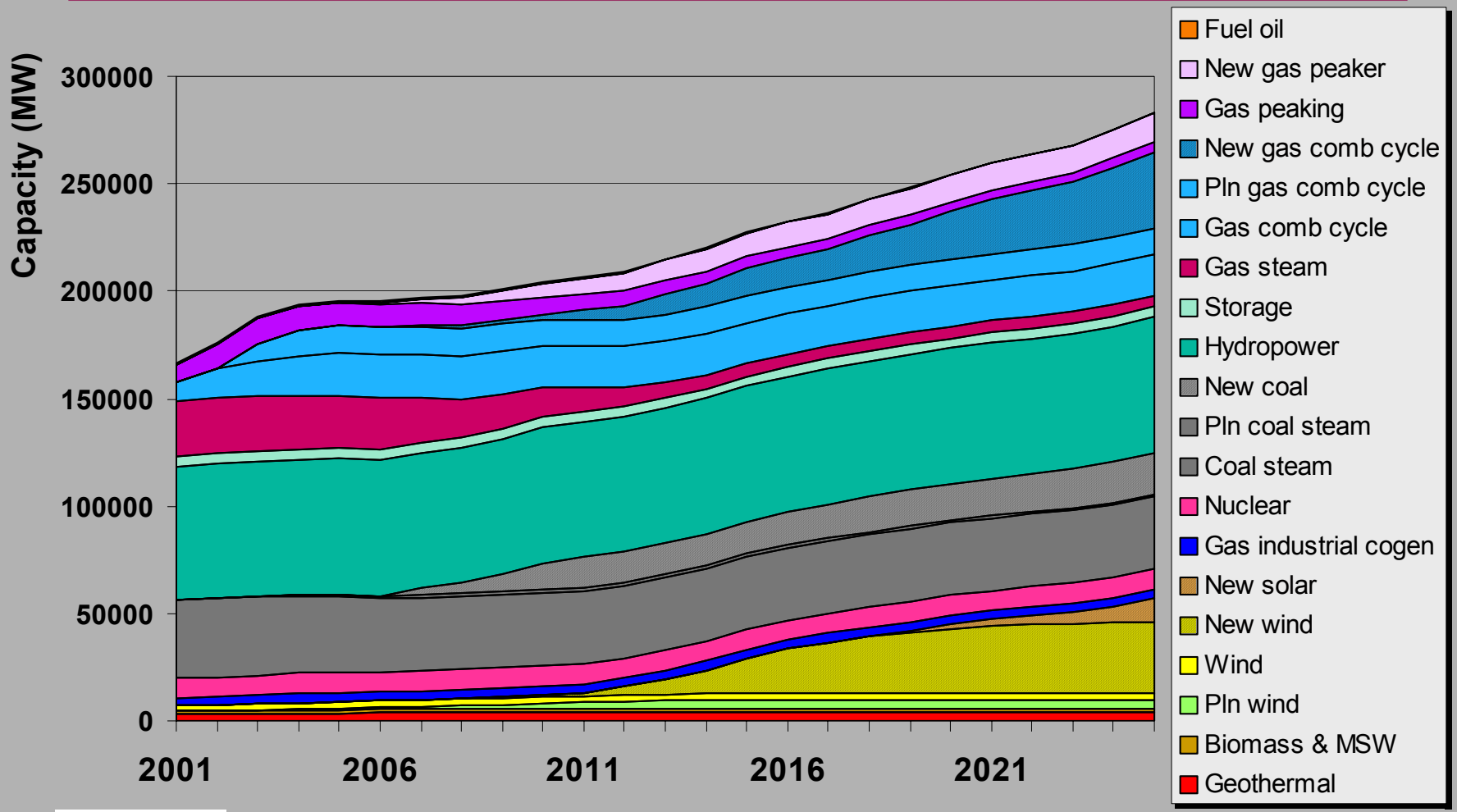
Fooling AURORA into building to a higher reserve level in a (roughly) cost-effective manner

- Increase operating reserve level (favors more baseload resources)
- Increasing cost of load curtailment (favors more peaking resources)
- Iterative process since planning reserve level cannot be specified.

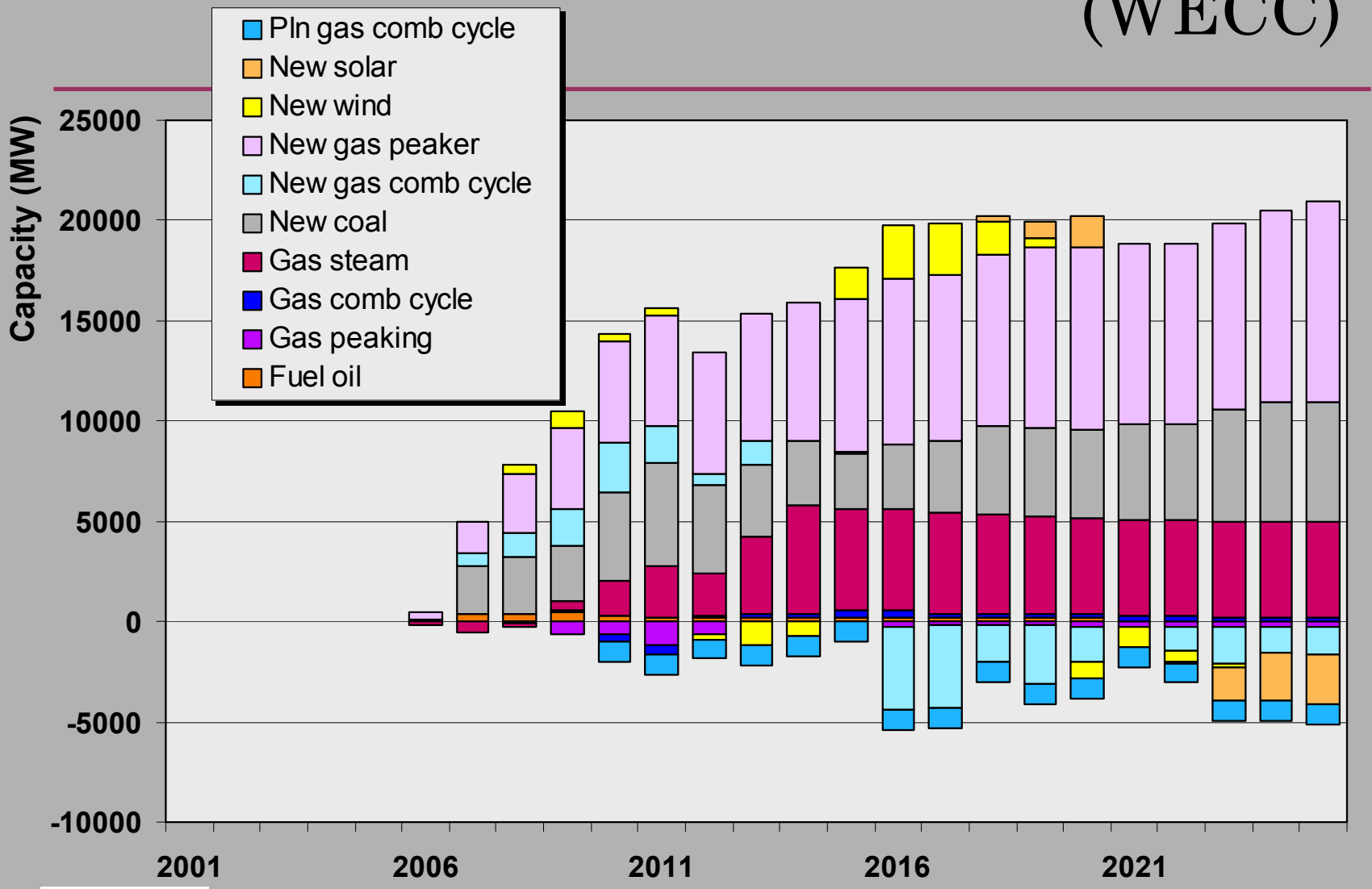
WECC & Northwest reserve margins: High Reserves case



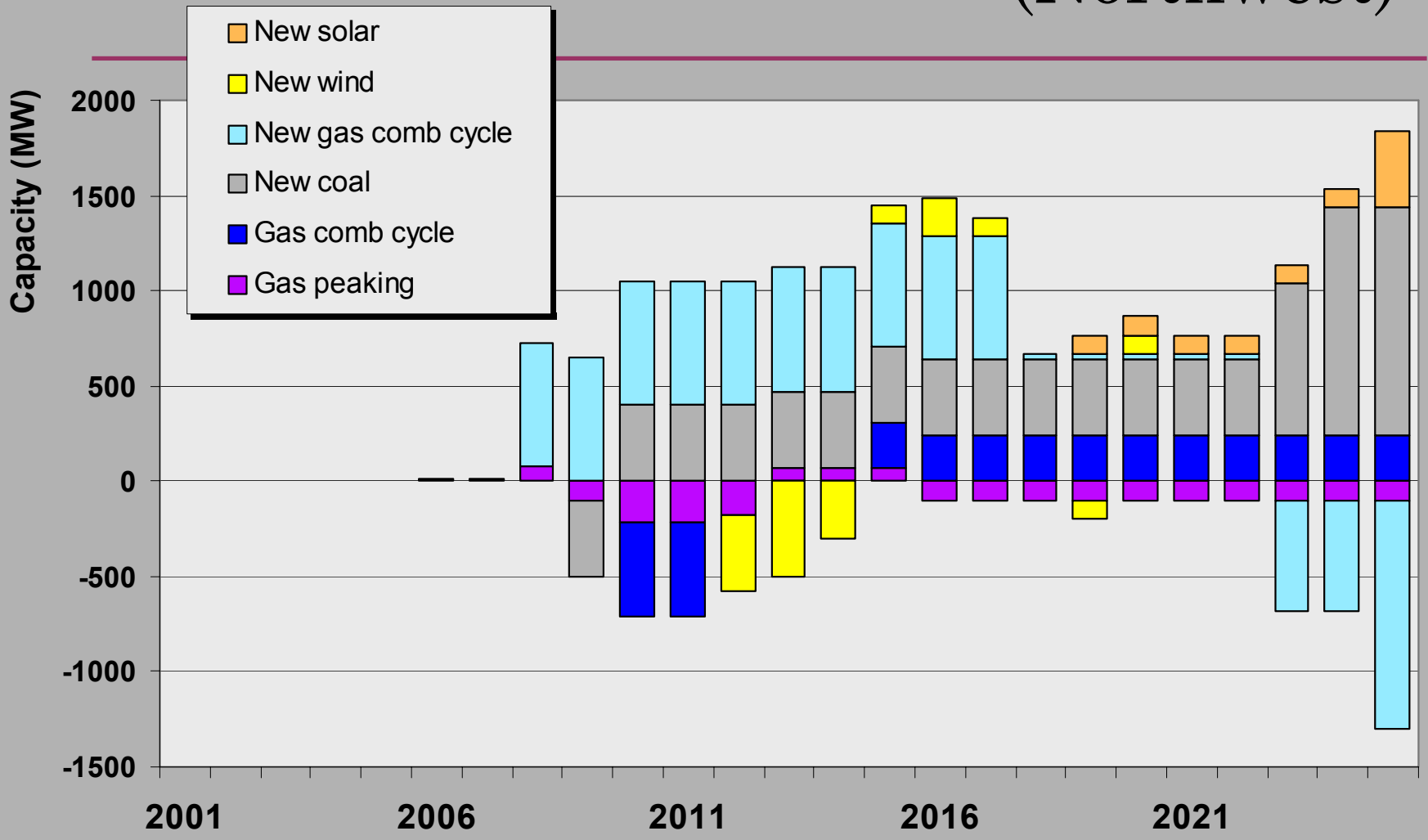
Resulting resource mix (WECC)



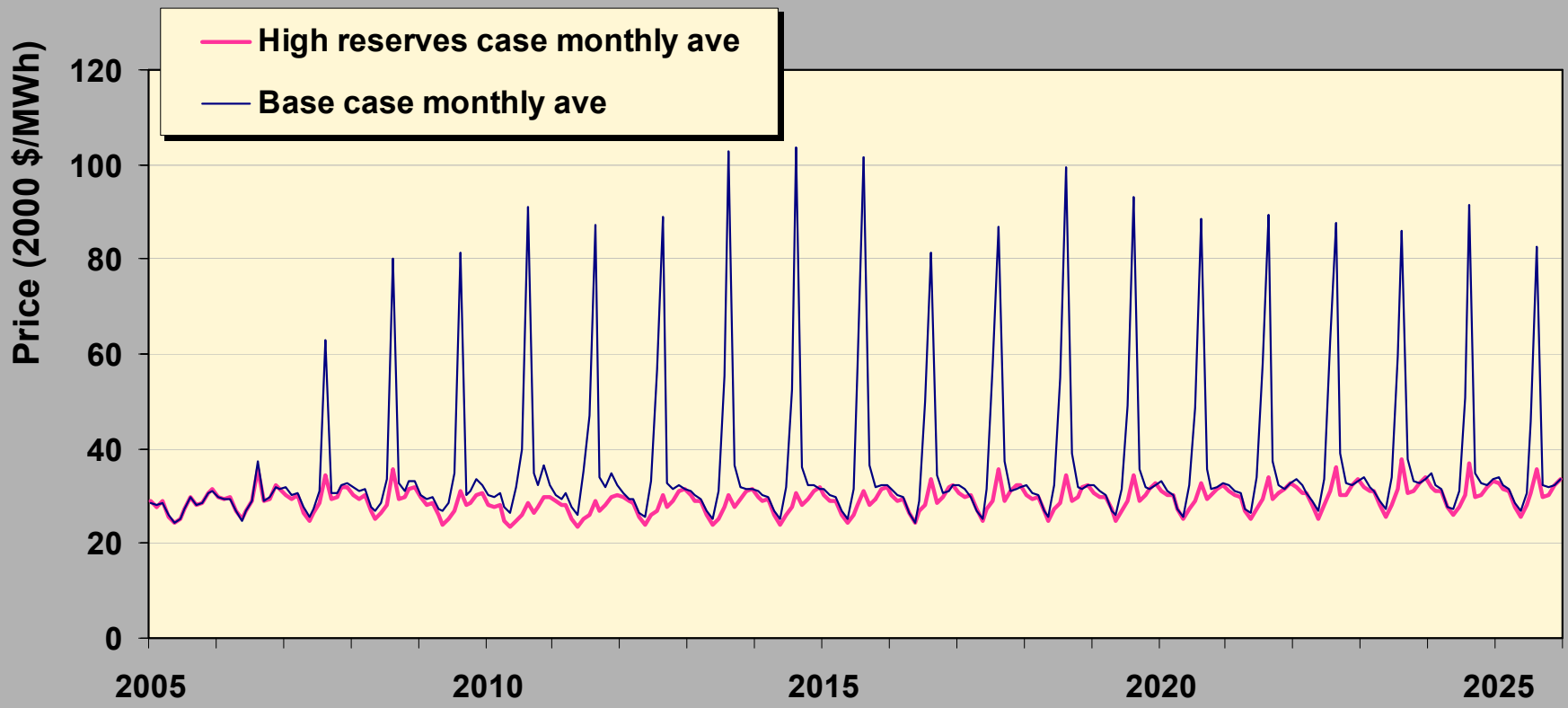
Change from base case resource mix (WECC)



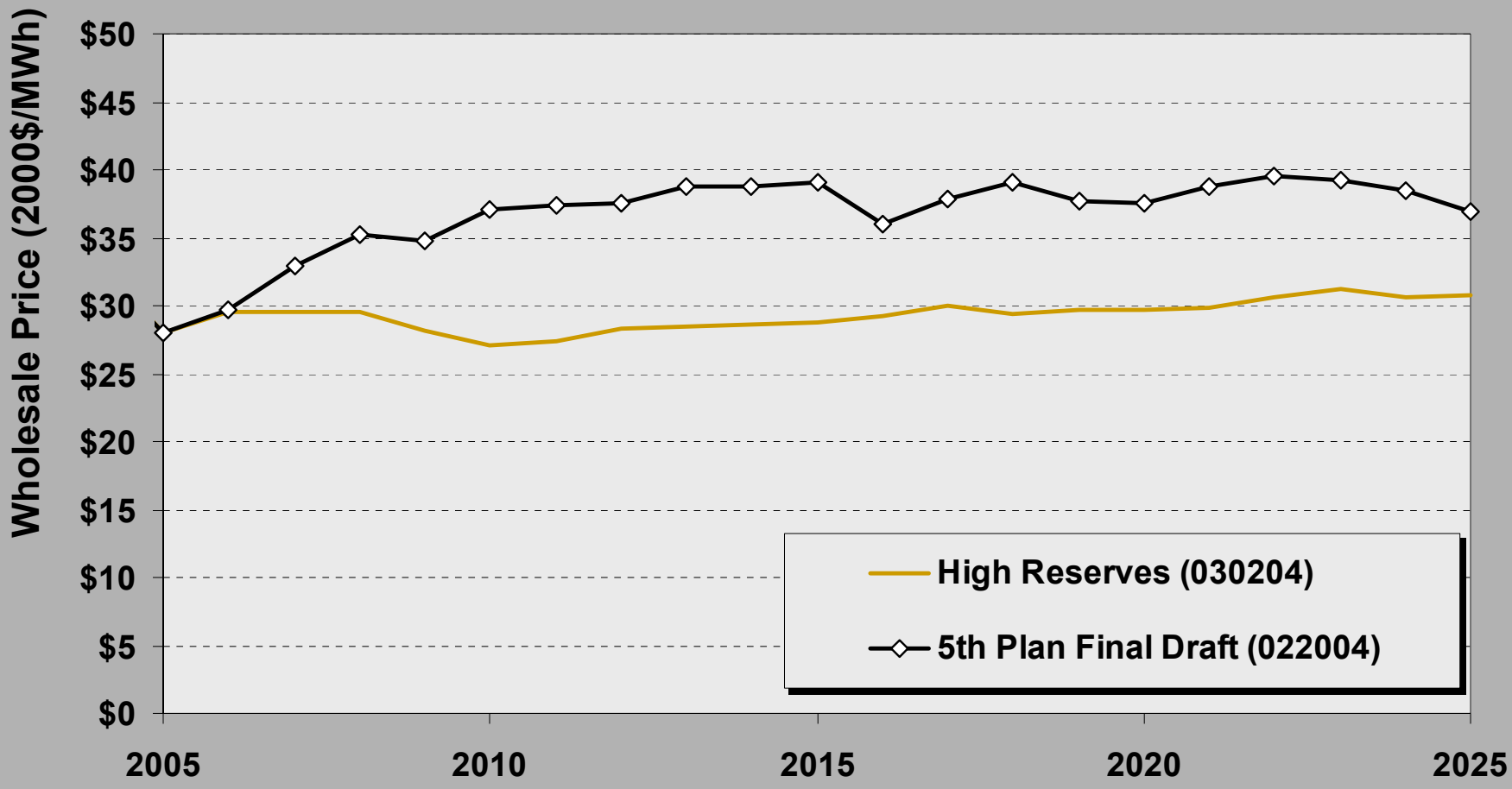
Change from base case resource mix (Northwest)



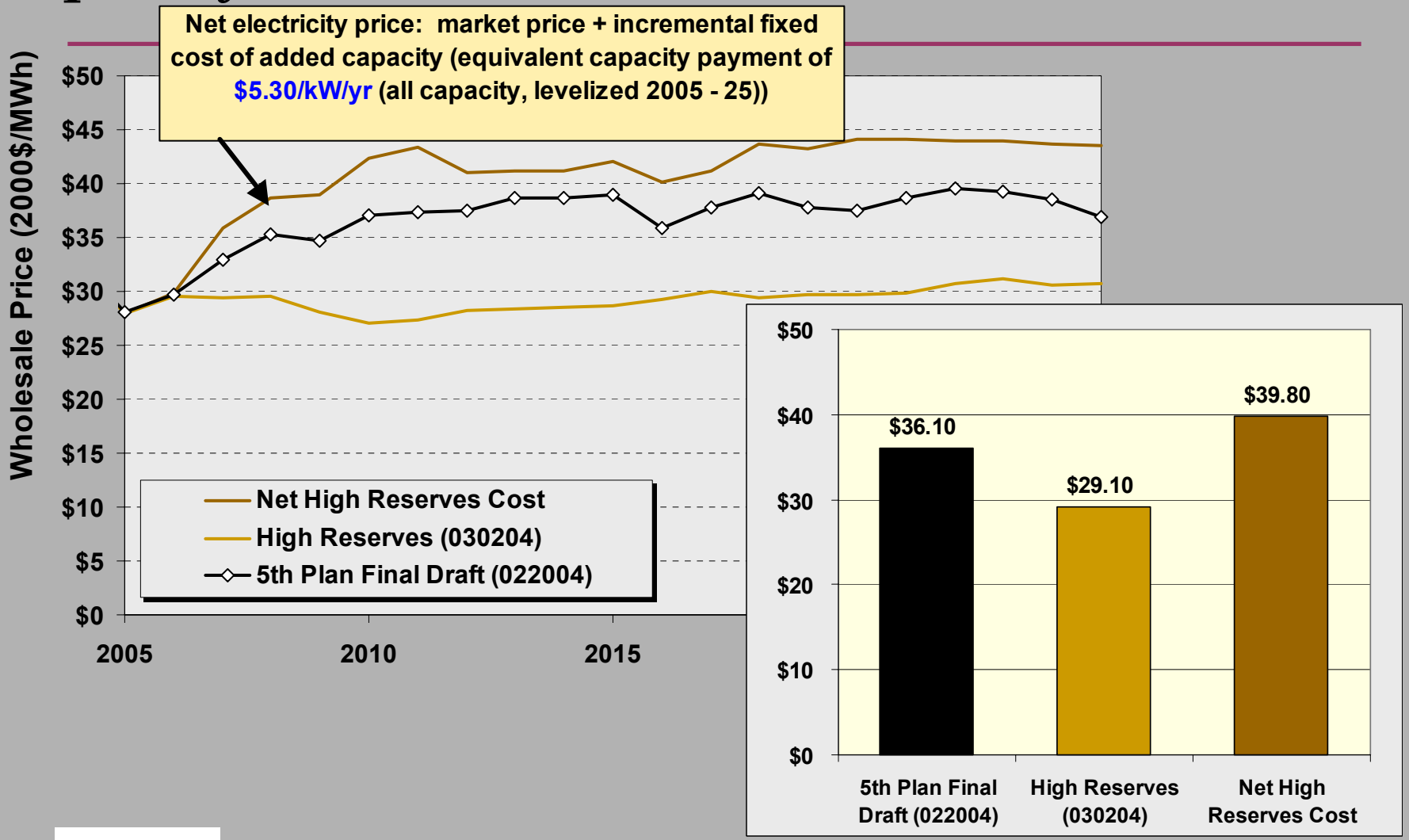
Peak period prices are suppressed



Market prices would be lower if resulting capacity is allowed to dispatch freely



But there is no free lunch… The additional capacity bears an incremental fixed cost



Observations

- Improved resource adequacy vs what the market might deliver can be secured by developing additional generating (or demand reduction) capacity
- May not be needed as much in the Northwest, but Northwest reliability depends upon availability of imports, e.g., resource adequacy elsewhere.
- Protects against longer-term unplanned events impacting ability to meet load
  - Poor water conditions
  - Unanticipated load growth
  - Failure to complete new generation as scheduled
- Dampens peak period prices

Observations, continued

- Achieving a 15% reserve margin on average throughout WECC raises forecast electricity prices about 10% if incremental fixed costs of the additional capacity is rolled into spot market prices.
- Exactly how this would be done (encouraging the additional generation while not distorting market prices and underlying market incentives for new generation) is not resolved.
- Capacity payments are used in some areas (PJM & NY ISO for example). The capacity payment equivalent to the incremental fixed costs incurred to maintain a 15% WECC reserve margin is about $5.30/kW/yr (levelized and spread across all capacity)