CAES LSL Cap proposal overview

JANUARY 31ST, 2013

Apex·CAES

BACKGROUND

- The ERCOT Protocols specify a number of caps and floors used in offer validation and in mitigation for each resource. At this time these are not specified for storage resources.

- Caps and Floors in the Protocols:
  - 4.4.9.2.3 Startup Offer and Minimum Energy Offer Generic Caps
  - 4.4.9.3.3 Energy Offer Curve Caps for Make-Whole Calculation Purposes
  - 4.4.9.4.1 Mitigated Offer Cap
  - 4.4.9.4.2 Mitigated Offer Floor
  - 5.6.1 Verifiable Costs
  - 7.9.1.3 Minimum and Maximum Resource Prices

- This presentation is a proposal for a framework which would be applicable to several of these items but the examples are specific to the Minimum Energy Offer Generic Cap, a.k.a. the “LSL Cap”

RATIONALE

- Existing LSL caps for other technologies are either a fixed $/MWH or 100% indexed to natural gas

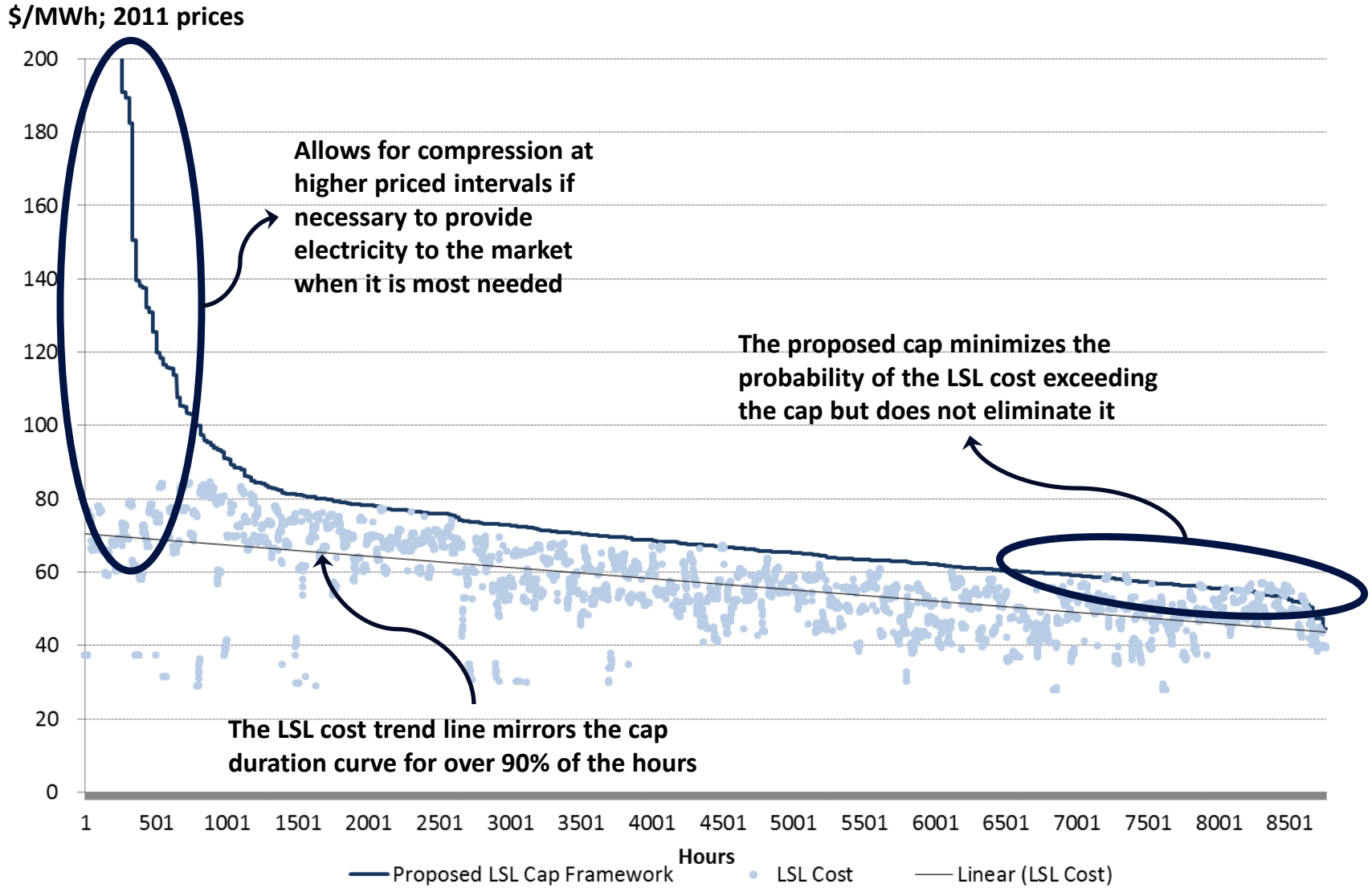
- Neither options works well for compressed air energy storage (CAES) given its primary cost drivers
  - Approximately 50% of the LSL cost is directly related to compression costs which are a function of prevailing power prices
  - Approximately 35-40% of the LSL cost is directly linked to gas
  - Approximately 10-15% of LSL cost is related to operations & maintenance

- Apex CAES™ is proposing an LSL cap that appropriately incorporates each of its primary cost drivers

- The proposed cap has multiple advantages
  - The resulting price cap is better correlated to the estimated LSL costs for CAES
  - The proposed formula accounts for situations when a CAES asset might need to compress at higher priced intervals in order to provide electricity to the market when it is most needed

- The high level formula would be as follows:
  - LSL cap = _a_ x the previous day's DAM price + _b_ MMBtu/MWh x HSC + _c_ $/MWh
  - The proposed cap formula has the potential to be customized to match the characteristics of other storage technologies

APEX PROPOSED CAP DURATION CURVE RELATIVE TO LSL COSTS



LSL cost is based on the weighted average cost of compression associated with standard dispatch and could increase significantly if additional compression is required as a result of suboptimal dispatch

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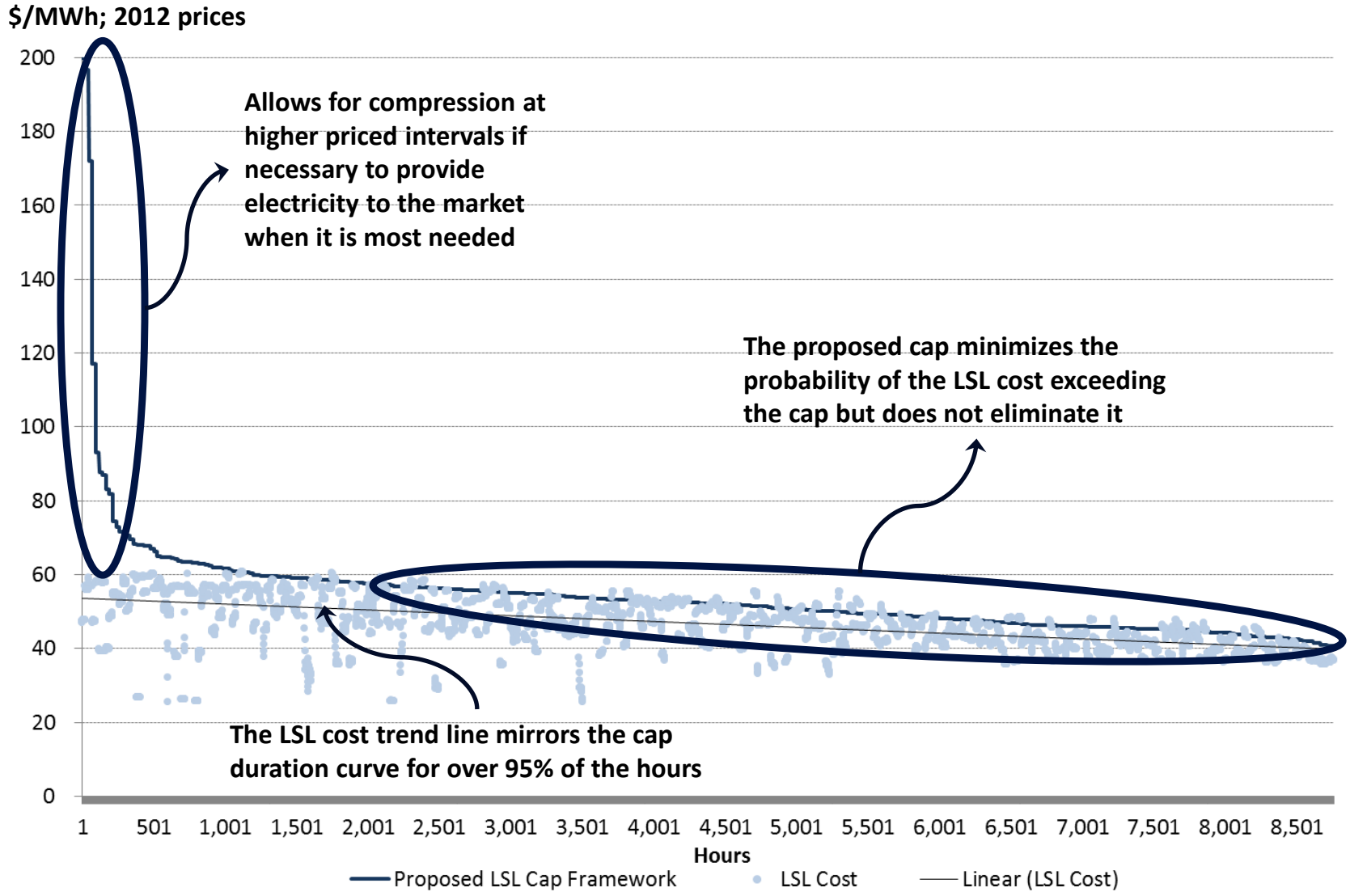

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FURTHER DISCUSSION

- Is the proposed framework appropriate for all potential storage technologies that might participate in the DAM or RUC?
- Should the protocols just contain the framework or should we attempt to assign values to the variables: a, b, & c?
- Should we attempt to introduce a state of charge variable right now? Including state of charge in commitment programs at ERCOT would reduce, and maybe eliminate, the possible over commitment of limited fuel resources such as storage and potentially hydro.