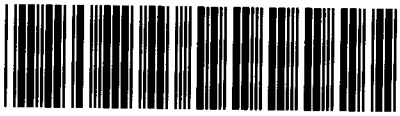

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PROJECT NO. 40000

COMMISSION PROCEEDING TO ENSURE RESOURCE ADEQUACY IN TEXAS	§ § §	**PUBLIC UTILITY COMMISSION OF TEXAS**

ERCOT PRESENTATION REGARDING POTENTIAL IMPLEMENTATION OF SCARCITY PRICING PROPOSAL OFFERED BY PROFESSOR HOGAN

COMES NOW, Electric Reliability Council of Texas, Inc. (ERCOT) and submits, as Attachment A, a presentation entitled "Interim Solutions to Improve Scarcity Pricing by Utilizing Reserve Demand Curves."

ERCOT prepared this presentation in response to the Commission's request to "study [the] impacts on pricing of operating reserves"[1] that would result from implementation of the concepts discussed in the paper prepared by Professor William W. Hogan, and filed in this project by IPR-GDF SUEZ Energy North America, Inc.[2]

ERCOT will be available to discuss these issues at the January 24, 2013 Open Meeting, and at the meeting the same afternoon in which Professor Hogan will discuss his paper.

Respectfully submitted,

By: Bill Magness

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ATTORNEY FOR ELECTRIC RELIABILITY COUNCIL OF TEXAS, INC.

[1] Project No. 40000, Competitive Markets Staff Memorandum, at 3 (Interchange Item 368).

[2] *Id.*, Supplemental Comments of IPR-GDF SUEZ Energy North America, Inc. (comments attach Professor Hogan's paper entitled "Electricity Scarcity Pricing Through Operating Reserves: An ERCOT Window of Opportunity") (Interchange Item 355).

ERCOT

Attachment A

Interim Solutions to Improve Scarcity Pricing by Utilizing Reserve Demand Curves

John Dumas
Director, Wholesale Market Operations
Electric Reliability Council of Texas, Inc.

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Background & Objectives of ERCOT Presentation

- GDF SUEZ commissioned Professor William W. Hogan to draft "Electricity Scarcity Pricing through Operating Reserves: An ERCOT Window of Opportunity." Professor Hogan's paper was filed in PUCT Project No. 40000 on November 14, 2012.

- At its November 16, 2012 Open Meeting, the Commission directed ERCOT to study and report on the potential implementation of the proposals in Professor Hogan's paper.

- ERCOT reported to the Commission that one element important to Professor Hogan's approach (the real-time co-optimization of energy and ancillary resources) could not be implemented by ERCOT in the near-term, and would require further investigation.

- ERCOT committed to work with Professor Hogan to determine if key aspects of Professor Hogan's approach could be implemented in the near-term, and to provide alternatives for such near-term action.

- In this presentation, ERCOT outlines two potential interim solutions to achieve a key objective of Professor Hogan's paper: improving scarcity pricing by utilizing reserve demand curves.

- ERCOT staff appreciate Professor Hogan's time and cooperation in this endeavor.

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Interim Solution A: Scarcity Pricing in Real-Time Energy Market by Modifying Generator Energy Offer Curve

- Slope the current offer floors to better reflect the value of diminished operating reserves

- The value of diminished operating reserves are reflected in the energy prices upon deployment of energy

- Generator Energy Offer Curve (EOC) portion corresponding to:
  - Non-Spin capacity responsibility priced along linear segment as per the following rules:
    - First MW of Non-Spin capacity on EOC priced at an administrative offer floor
    - Last MW of Non-Spin capacity on EOC priced at LOLP*VOLL, where LOLP is determined at Operating Reserve level of RegUp+RRS Load Resources+RRS Gen Resources
  - RRS capacity responsibility priced along linear segment as per the following rules:
    - First MW of RRS capacity on EOC to LOLP*VOLL, where LOLP is determined at Operating Reserve level of RegUp+RRS Load Resources+RRS Gen Resources
    - Last MW of RRS capacity on EOC priced at VOLL
  - RegUp capacity responsibility priced at VOLL

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Interim Solution A: Scarcity Pricing in Real-Time Energy Market by Modifying Generator Energy Offer Curve

- With this approach, need co-ordination of the values of Power Balance Penalty Curve, SWCAP and VOLL.
  - For Summer 2013, SWCAP may be used in place of VOLL
- Base Points and LMPs are consistent
- SCED Step 2 mitigation may result in prices not reflecting scarcity conditions

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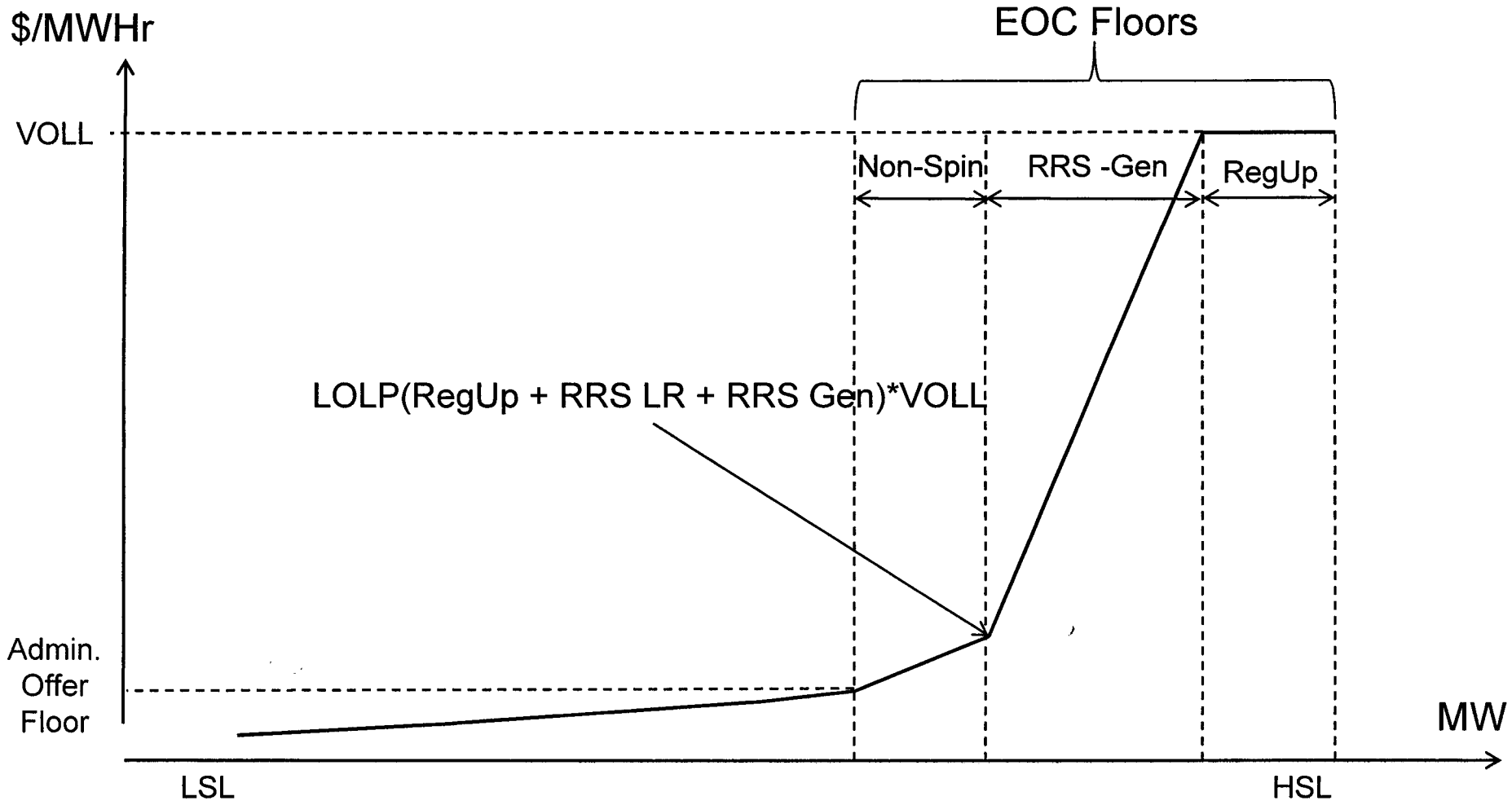
Interim Solution A: Scarcity Pricing in Real-Time Energy Market by Modifying Generator Energy Offer Curve



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EOC example with sloped floors for an On-Line Generator

Interim Solution B: Scarcity Pricing in Real-Time Energy Market by valuing remaining Operational Reserves

- Determine the Operational Reserve Demand Curve, as described in the following slide
- Remove current rules for EOC floors related to EOC portion corresponding to Ancillary Service Capacity Responsibility
- Introduce additional term $Pr(\sum BasePoint)$ in the SCED objective function. This new additional term is an increasing function that values the remaining reserves as a function of the total generation $(\sum BasePoint)$ in the system
- With this approach, co-ordination of the values of Power Balance Penalty Curve, SWCAP and VOLL needs to be considered
- SCED Step 2 mitigation will not impact the price adder and price formation during scarcity conditions will be improved
- Impact to current Day-Ahead Market needs to be evaluated

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Interim Solution B: Proposed Methodology for Determining the Operational Reserve Demand Curve

- Operational Reserve Demand Curve (ORDC) defines the incremental value of operating reserves
  - The value at any given level of available operating reserves is the product of the Loss of Load (LOLP) at that reserve level and the Value of Lost Load (VOLL)
- The width (MW) requirement of ORDC is determined using the formula:

$$ORDC_{MW} = \mu_{ForcedOutageMW} + Factor * \sqrt{(\sigma_{NetLoadForecastErrorMW})^2 + (\sigma_{ForcedOutageMW})^2}$$

Where,

$\mu_{ForcedOutageMW}$ is the average Forced Outage MW based on recent history

$\sigma_{NetLoadForecastErrorMW}$ is the standard deviation of Net Load Forecast Error MW based on recent history

$\sigma_{ForcedOutageMW}$ is the standard deviation of the Forced Outage MW based on recent history

$Factor$ is the confidence level that the combination of Net Load Forecast Error and Force Outage will be below a certain percentile (e.g. 95%=1.65, 97.7% = 2)

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Interim Solution B: Proposed Methodology for Determining the ORDC (cont'd)

- Operational Reserve Demand Curve MW width could be part of the monthly Ancillary Service calculation
- Value of Lost Load (VOLL) determined from one time study
- Determine the LOLP at the end of the ORDC (width of the ORDC)
- Determine the amount of Operational Reserves at which LOLP is 0.05 (5%)

$$\text{LOLP} = 0.05 \rightarrow \mu_{ForcedOutageMW} + 1.65 * \sqrt{(\sigma_{NetLoadForecastErrorMW})^2 + (\sigma_{ForcedOutageMW})^2}$$

- Determine the LOLP when the ORDC is at a level of RegUp+RRS from Load
- Build the ORDC (piecewise linear approximation)
  - Set the value of Operational Reserves at VOLL from 0 to (RegUp + RRS from Load)
  - Linear line segment from (RegUp+RRS from Load) valued at LOLP*VOLL to the Operational Reserves at LOLP of 5% which is valued at 0.05*VOLL
  - Linear line segment from Operational Reserves at LOLP of 5% valued at 0.05*VOLL to the last point (total width) of Operational Reserve which is valued at LOLP*VOLL

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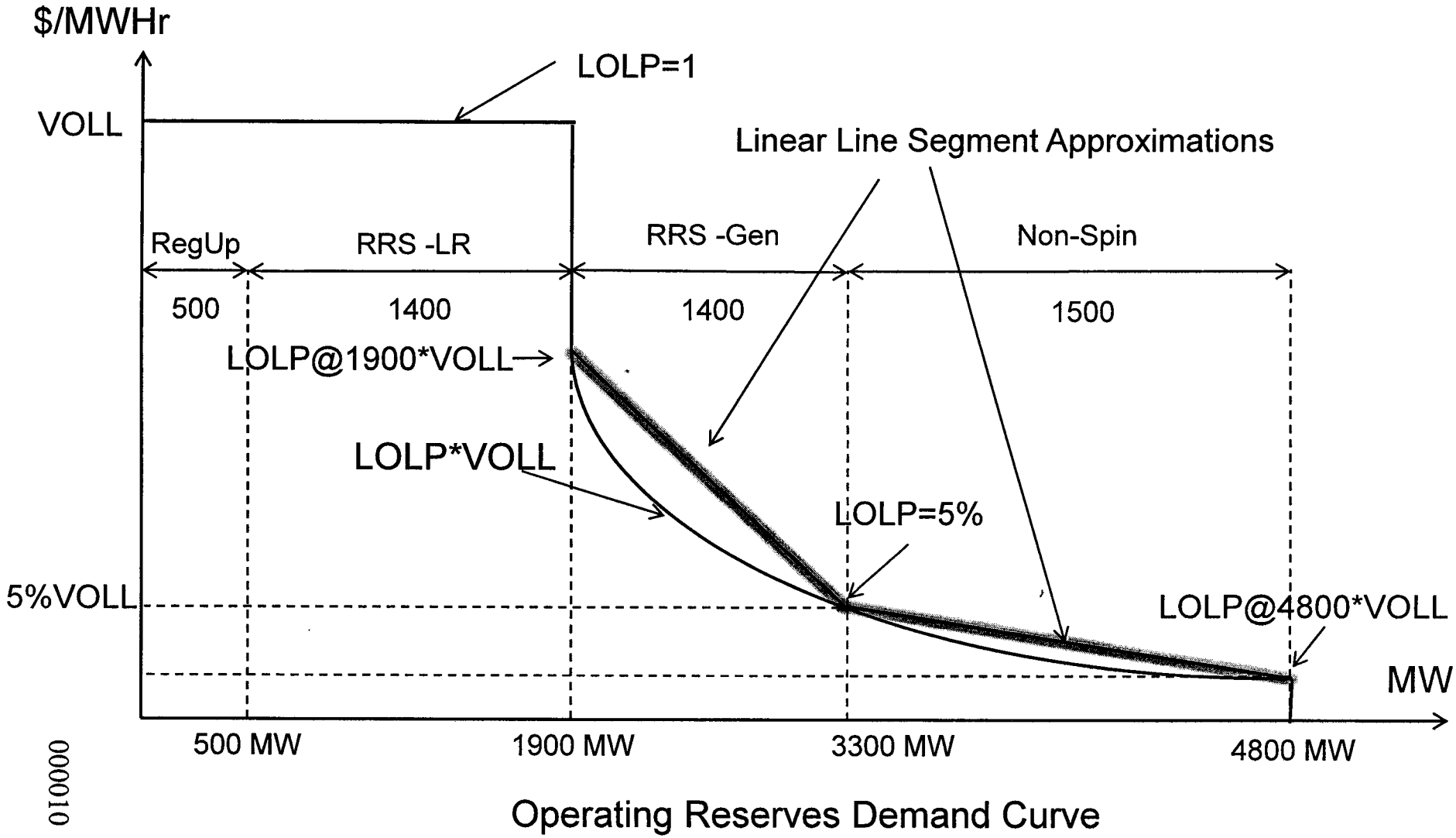
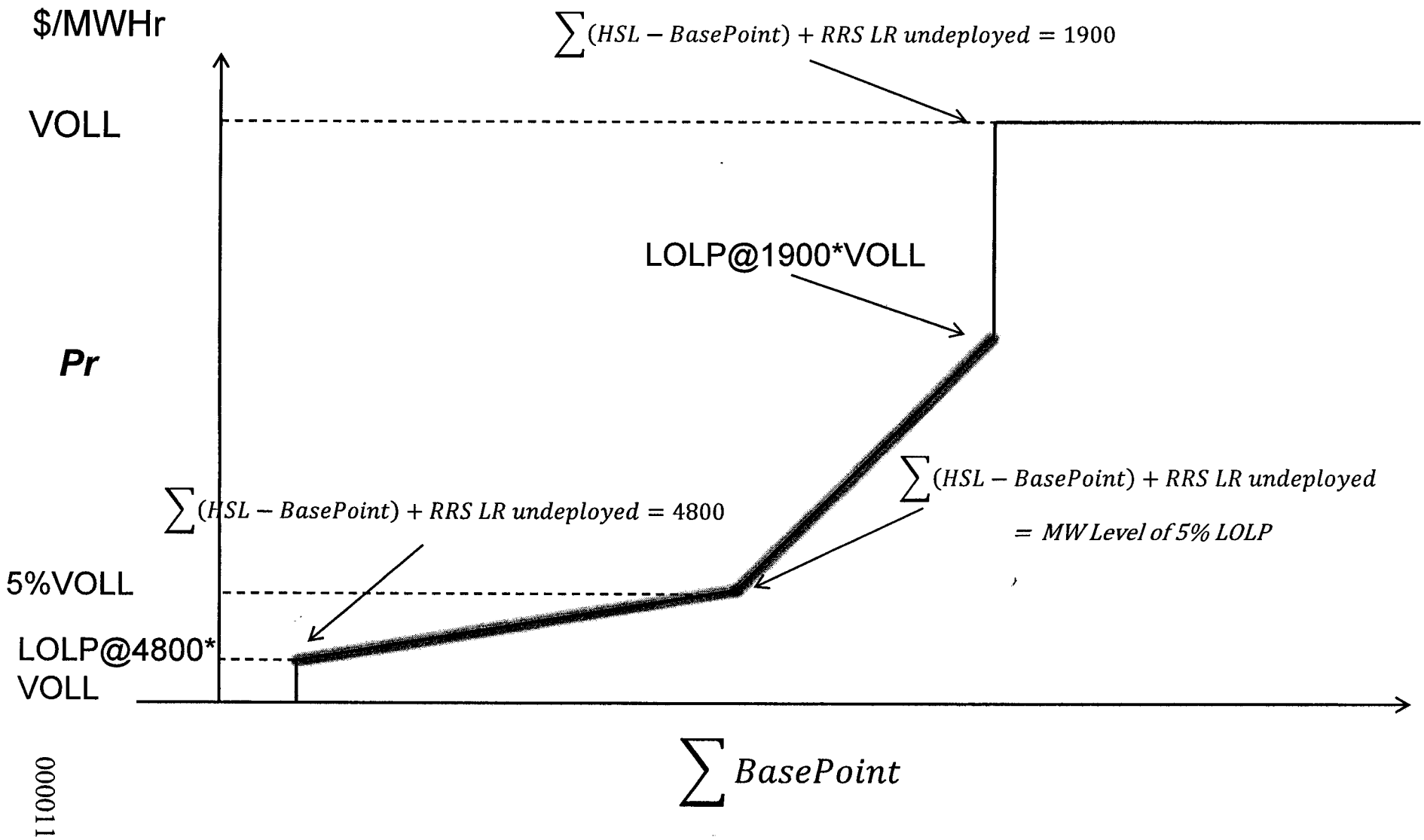
Proposal Methodology for Determining the Operational Reserve Demand Curve (ORDC) using 4800MW as an example



Operating Reserves Demand Curve

Interim Solution B:
Shape of $Pr(\sum BasePoint)$ derived from ORDC



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