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# PSE's Natural Gas Hedging Plan

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# Agenda

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- Key principles driving hedging improvements
- Market update – forward price history
- Review of previous hedging plan for November 17 – October 18
- Overview of current hedging plan for November 18 – October 19
- Programmatic and discretionary strategy
- Risk responsive strategy, modeling and oversight
- Summary

# Hedging Program - Key Principles Driving Improvements

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## Price risk management has two key components:

### 1. Risk to higher prices

- This results in increased commodity costs on unhedged position.

### 2. Risk to lower prices

- Adding hedges to constrain higher future prices increases the risk of hedge costs if prices drop.

PSE's hedging plan takes these components into account and remains consistent with Michael Getting's whitepaper suggesting a robust hedging program should:

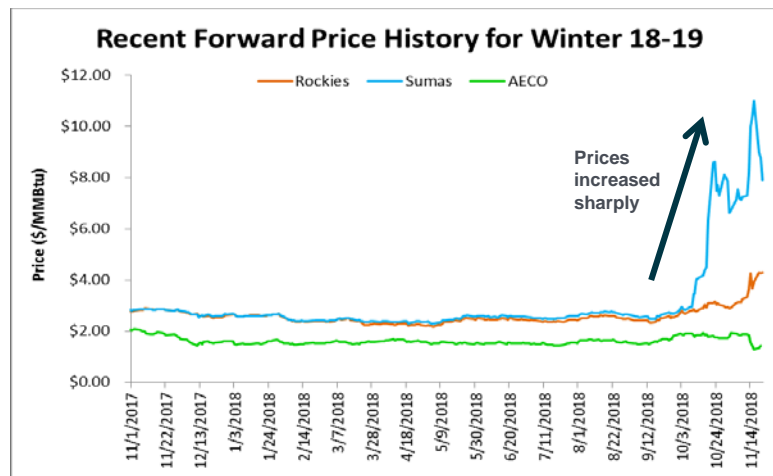
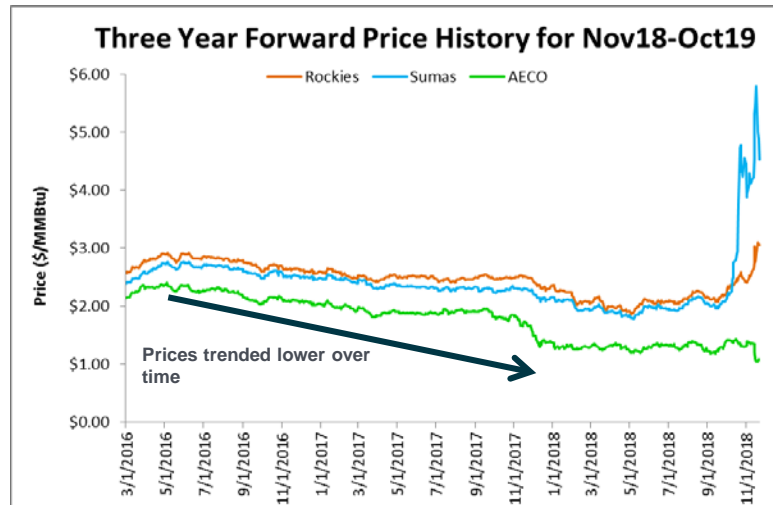
- Mitigate the risk to higher prices while allowing sufficient participation in falling prices.
- Monitor market conditions measuring price and volatility.

# Market Update - Price Moves in Energy Markets Tend to be Asymmetrical

Price moves higher are typically more extreme than price drops.

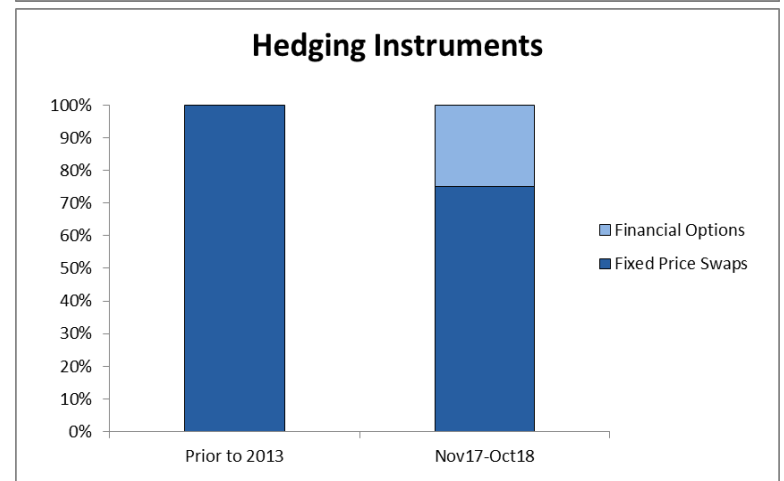
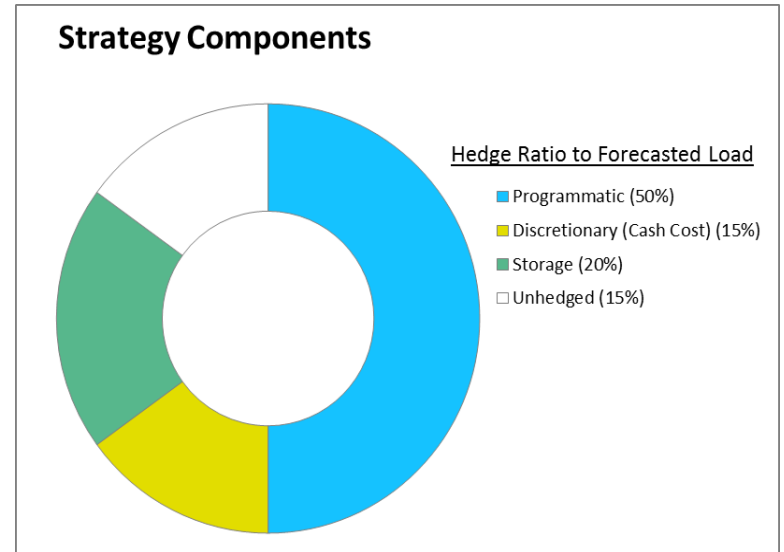
## Key Takeaways:

- The future price of natural gas is unknown and can be highly volatile.
- PSE has exposure to AECO, Sumas, and Rockies prices.
- A strategy responsive to changing market prices and volatility can help manage price spikes.



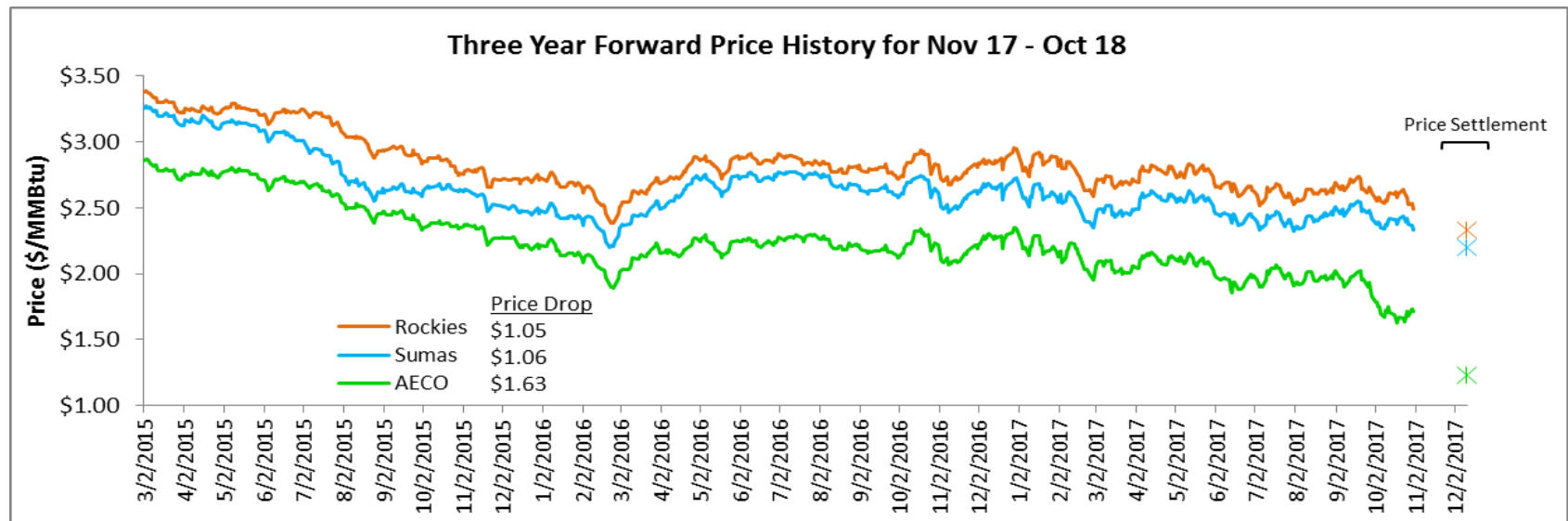
# Review of Previous Hedging Plan – Gas Year November 17 – October 18

- PSE hedged 50% of forecasted load with a programmatic strategy.
- PSE’s discretionary strategy increases the hedge ratio by an additional 15%.
- Storage inventory is integrated into the hedging program as withdrawal capacity mitigates winter price exposure.
- PSE includes financial options as a hedging instrument to allow sufficient participation in lower prices.



# Gas Year November 17 – October 18 Results

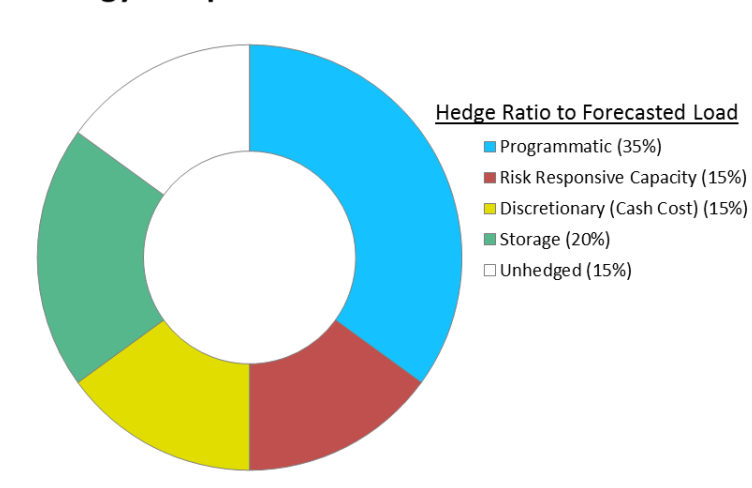
- Prices trended lower throughout the three year hedging time horizon.
  - PSE commodity WACOG dropped 10% year over year from \$2.65/MMBtu (Nov16-Oct17) to \$2.39/MMBtu (Nov17-Oct18).
  - Commodity over collection (deferral) of \$45.6 Million for the gas year.



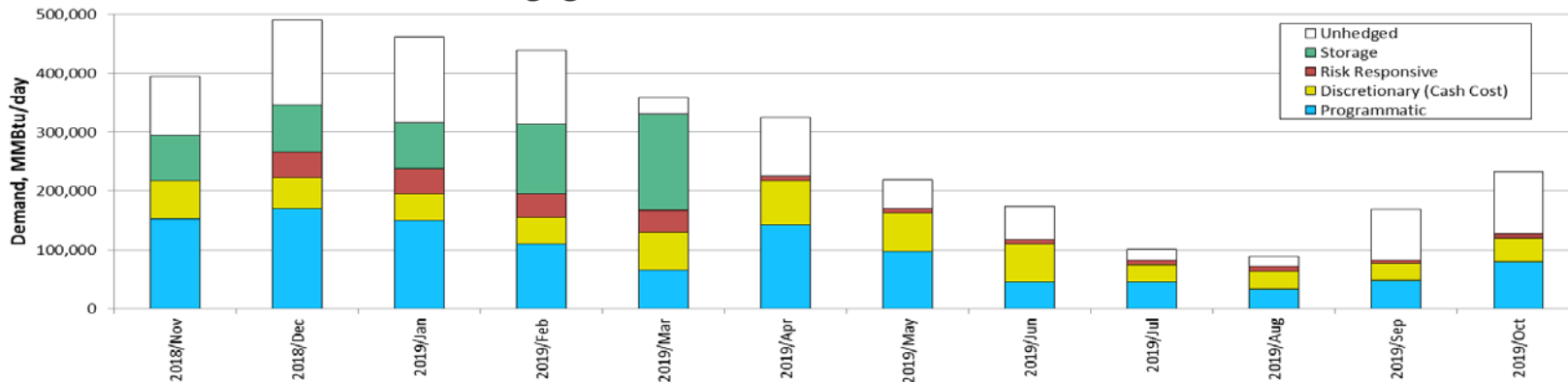
# Overview of Current Hedging Plan for November 18 – October 19

- The programmatic strategy was reduced from 50% to a moderate 35% of forecasted load.
- PSE implemented a risk responsive strategy increasing hedging capacity by 15%.
- PSE maintained the existing discretionary strategy.
- Storage withdrawal capacity increases hedge ratios in the winter to offset higher loads.

**Strategy Components**



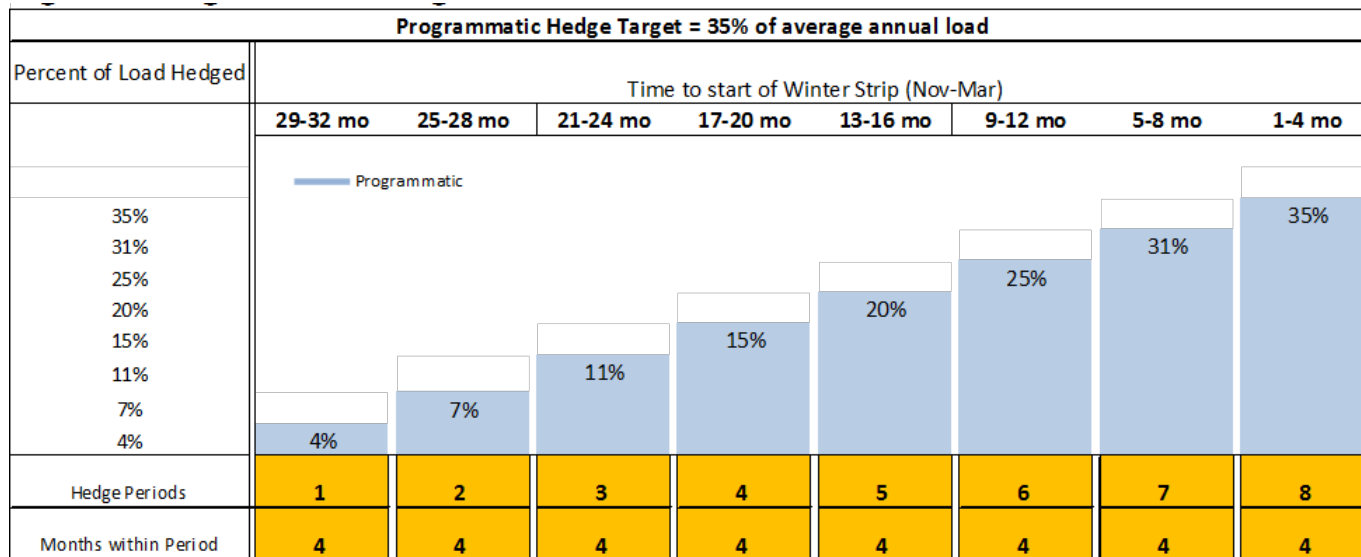
**Hedging Plan and Load Profile for Nov 18 - Oct 19**



# Programmatic Hedging Reduces Price Volatility

The goal of PSE’s programmatic hedging strategy is to provide a specified minimum volume of forward price protection.

- Programmatic hedge ratio is 35% to forecasted load.
- This strategy adds hedges over three years, dollar cost averaging prior to delivery.
- A three year forward hedge time horizon reduces the risk of hedge concentration.

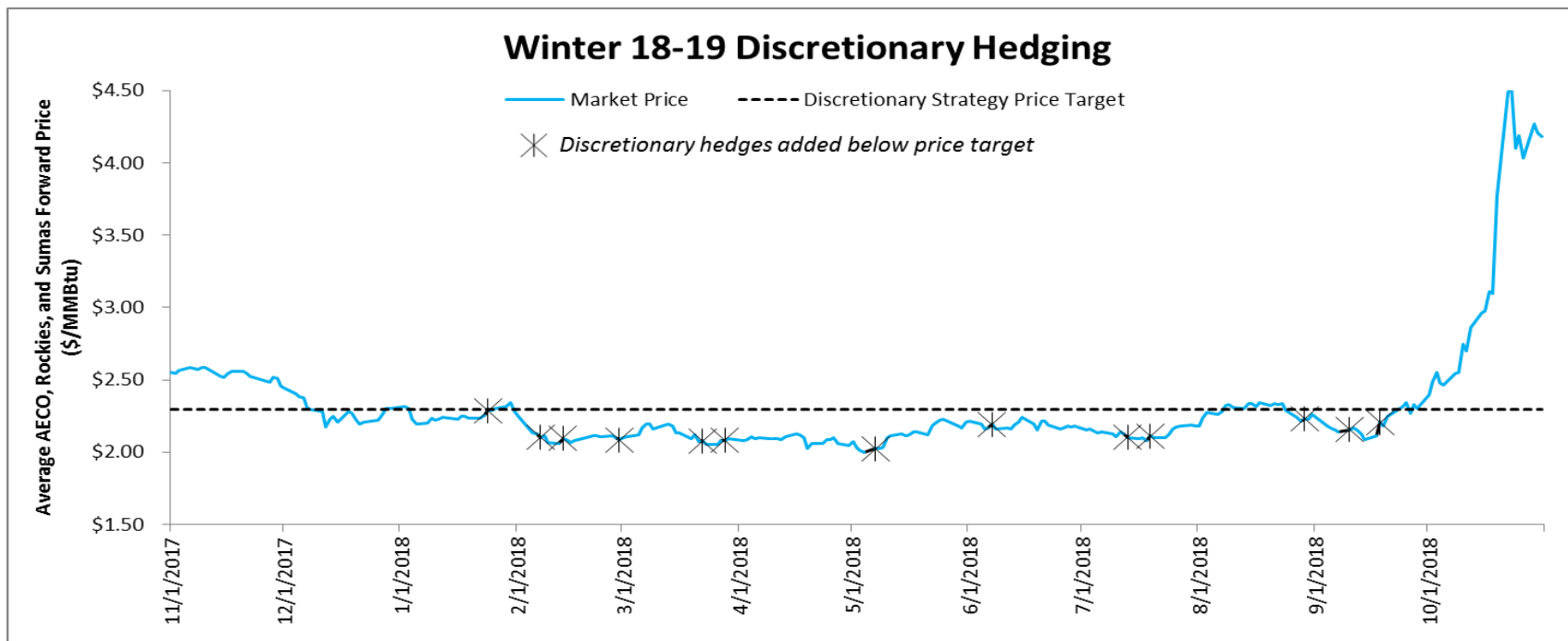




# PSE's Discretionary Strategy is Opportunistic

The goal of PSE's discretionary hedging strategy is to identify low cost opportunities to reduce risk.

- This hedging strategy takes advantage of low prices resulting from near term market fundamentals.
- Hedges are added over a shorter, 12–18 month time horizon.
- Defined quantitative price triggers are calculated annually.



# PSE's Risk Responsive Strategy Reacts to Changing Market Conditions

The illustration below represents our risk responsive approach in which hedges are added based on changes to price and volatility.

## Tolerance Boundaries

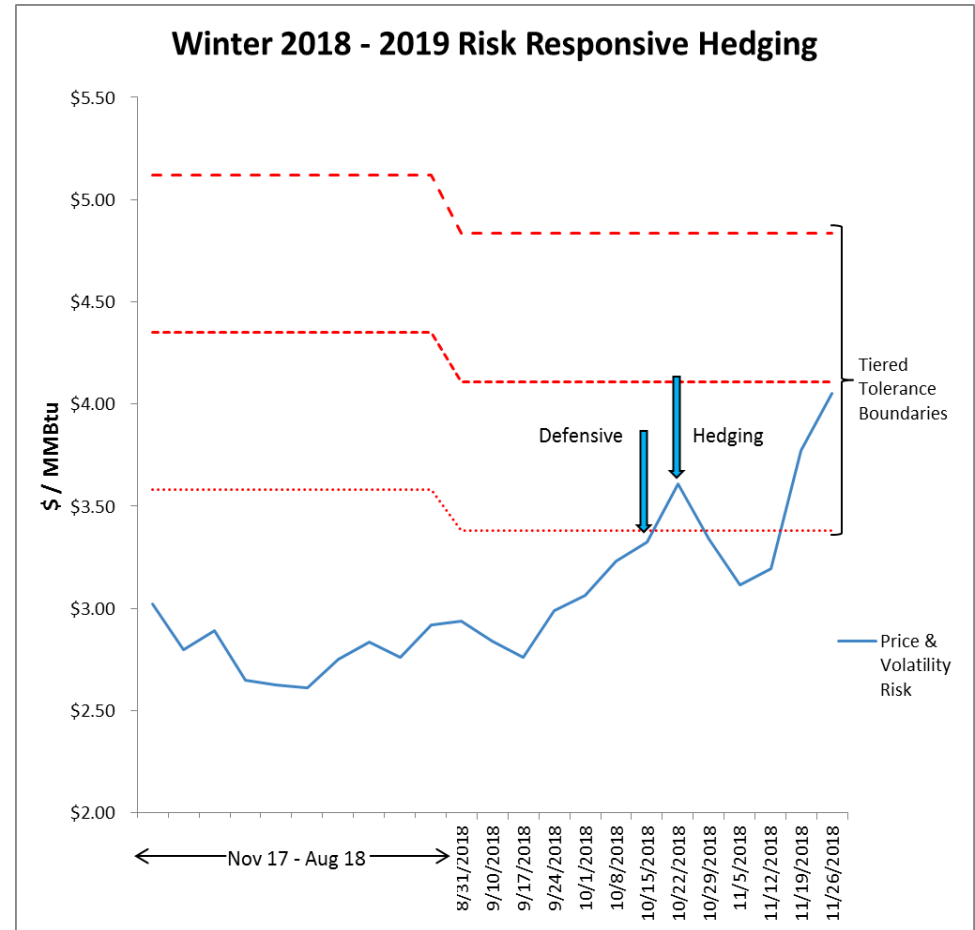
- The red line lines are defined tolerance boundaries that trigger hedging when breached.

## Risk Measurement

- The blue line represents the combination of forward market prices and volatility which measures potential price increases.

## Defensive Hedging

- Hedging was triggered on October 15<sup>th</sup> and 22<sup>nd</sup> 2018 returning exposure to within tolerance boundaries.



# Risk Responsive Model

The table below is an example of weekly output from the Risk Responsive Model that measures and monitors market prices and volatility to calculate the risk exposure to potential higher prices.

Risk Responsive Model Output									
Report Date	Winter Sumas Price (\$/MMBtu)	Volatility	Measured Risk Before Hedging	Tolerance Boundary 1	Tolerance Boundary 2	Tolerance Boundary 3	Hedge Required	Measured Risk After Hedging	Responsive Hedge Volume (MMBtu/d)
8/31/2018	\$2.74	19%	\$ (17,762,089)	\$ (20,459,630)	\$ (24,860,395)	\$ (29,261,160)	No	\$ (17,762,089)	50,000
9/10/2018	\$2.64	19%	\$ (17,172,649)	\$ (20,459,630)	\$ (24,860,395)	\$ (29,261,160)	No	\$ (17,172,649)	50,000
9/17/2018	\$2.57	20%	\$ (16,697,625)	\$ (20,459,630)	\$ (24,860,395)	\$ (29,261,160)	No	\$ (16,697,625)	50,000
9/24/2018	\$2.77	21%	\$ (18,096,237)	\$ (20,459,630)	\$ (24,860,395)	\$ (29,261,160)	No	\$ (18,096,237)	50,000
10/1/2018	\$2.83	20%	\$ (18,536,640)	\$ (20,459,630)	\$ (24,860,395)	\$ (29,261,160)	No	\$ (18,536,640)	50,000
10/8/2018	\$2.97	22%	\$ (19,544,612)	\$ (20,459,630)	\$ (24,860,395)	\$ (29,261,160)	No	\$ (19,544,612)	50,000
<b>10/15/2018</b>	<b>\$3.87</b>	<b>43%</b>	<b>\$ (27,256,230)</b>	<b>\$ (20,459,630)</b>	<b>\$ (24,860,395)</b>	<b>\$ (29,261,160)</b>	<b>Yes</b>	<b>\$ (20,111,079)</b>	<b>33,000</b>
<b>10/22/2018</b>	<b>\$8.05</b>	<b>88%</b>	<b>\$ (42,508,644)</b>	<b>\$ (20,459,630)</b>	<b>\$ (24,860,395)</b>	<b>\$ (29,261,160)</b>	<b>Yes</b>	<b>\$ (21,835,899)</b>	<b>17,500</b>
10/29/2018	\$6.77	98%	\$ (20,188,590)	\$ (20,459,630)	\$ (24,860,395)	\$ (29,261,160)	No	\$ (20,188,590)	17,500
11/5/2018	\$5.57	109%	\$ (18,855,255)	\$ (20,459,630)	\$ (24,860,395)	\$ (29,261,160)	No	\$ (18,855,255)	17,500
11/12/2018	\$5.79	112%	\$ (19,328,901)	\$ (20,459,630)	\$ (24,860,395)	\$ (29,261,160)	No	\$ (19,328,901)	17,500
11/19/2018	\$7.87	127%	\$ (22,821,057)	\$ (20,459,630)	\$ (24,860,395)	\$ (29,261,160)	No	\$ (22,821,057)	17,500
11/26/2018	\$7.81	143%	\$ (24,521,766)	\$ (20,459,630)	\$ (24,860,395)	\$ (29,261,160)	No	\$ (24,521,766)	17,500

- The risk responsive strategy allowed PSE to float on stable low market prices through the majority of 2018.
- On October 15<sup>th</sup> and 22<sup>nd</sup>, the combination of higher prices and volatility exceeded thresholds triggering hedging to reduce risk.
- When prices and volatility increased and triggered hedging, the three tiered tolerance boundaries protected against adding a large tranche of hedging in one interval.

# Governance and Control

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## **PSE has effective governance procedures in place to monitor and update hedging strategies.**

- The hedging program is governed by PSE's Energy Risk Policy and Procedures Manual.
- The Policy and Procedures are approved by PSE's Energy Management Committee (EMC), which is comprised of company officers and directors.

## **Risk Responsive Strategy – Roles and Responsibilities**

- The EMC reviewed and approved the recent reduction in programmatic hedging as well as the implementation of the risk responsive strategy.
- Front office:
  - Monitors the market and executes transactions.
  - Provides monthly hedging and market updates to the EMC.
- Middle office:
  - Validates prices, volatility, and the exposure calculation.
  - Reports the risk responsive model results weekly including exposure against established thresholds, which determine if hedging is required in the risk responsive strategy.
  - Validates execution of the triggered risk responsive hedges.

# Summary

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- PSE implemented two strategy changes to the November 2018 – October 2019 PGA year:
  - Reduced the existing programmatic strategy from 50 percent to 35 percent.
  - Added a new risk responsive strategy equal to 15 percent of annual load.
- These changes were consistent with hedging practice discussions that occurred in the workshops hosted by the WUTC.
- In combination with PSE’s existing strategies, these changes meet PSE’s objective of developing a robust hedging program that balances risk reduction with hedge costs.
- PSE will continue to monitor market conditions and evaluate strategy improvements.