Commodity Risk Management for Short Term Domestic Energy Obligations

Regulatory Workshop on Electricity Hedging

June 2007

BC hydro

Presentation Agenda

1. Introduction and Background
2. Risk Measurement
3. Risk Benefit Analysis
4. Review of Current Policy
5. Closing

SECTION 1

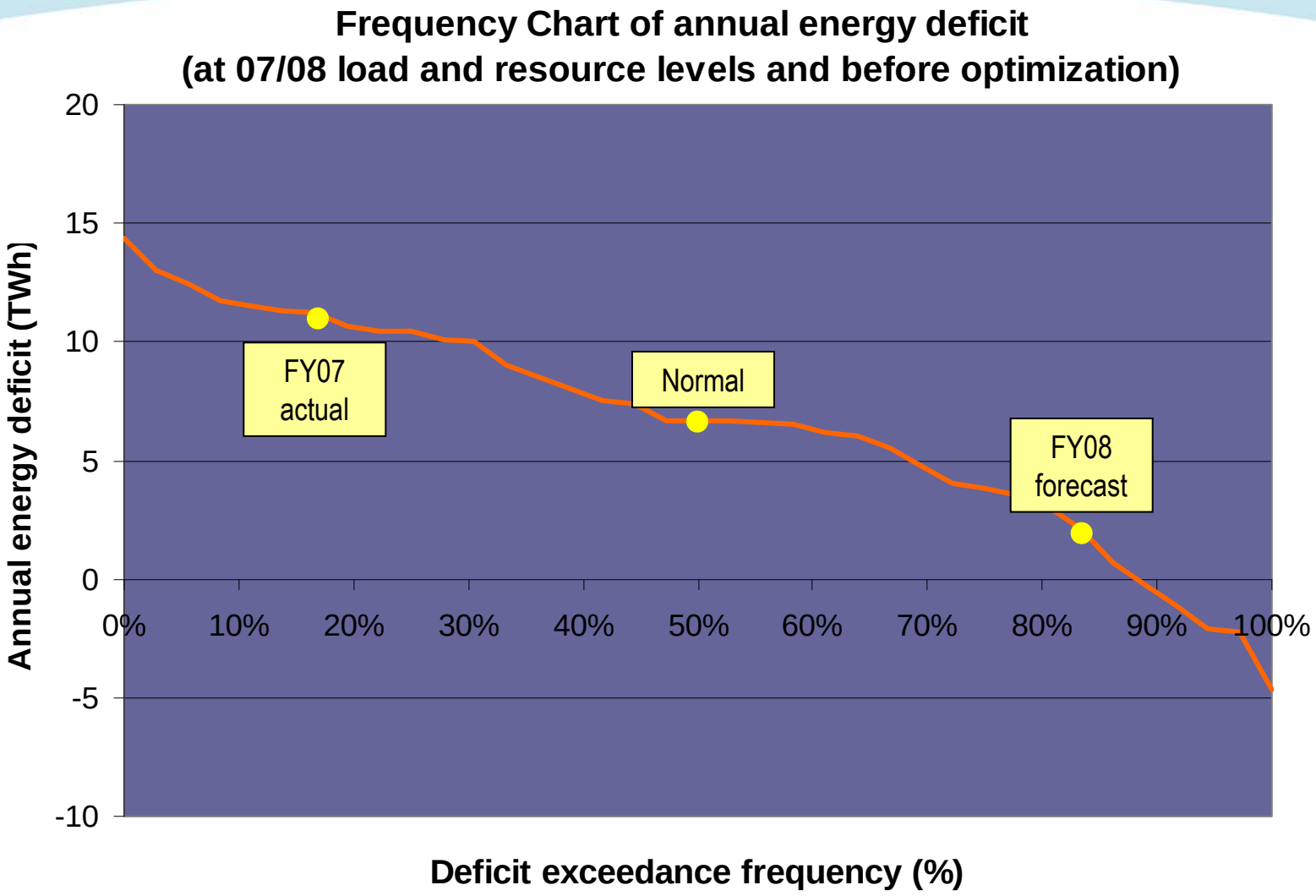
Introductions

Reason for Presentation

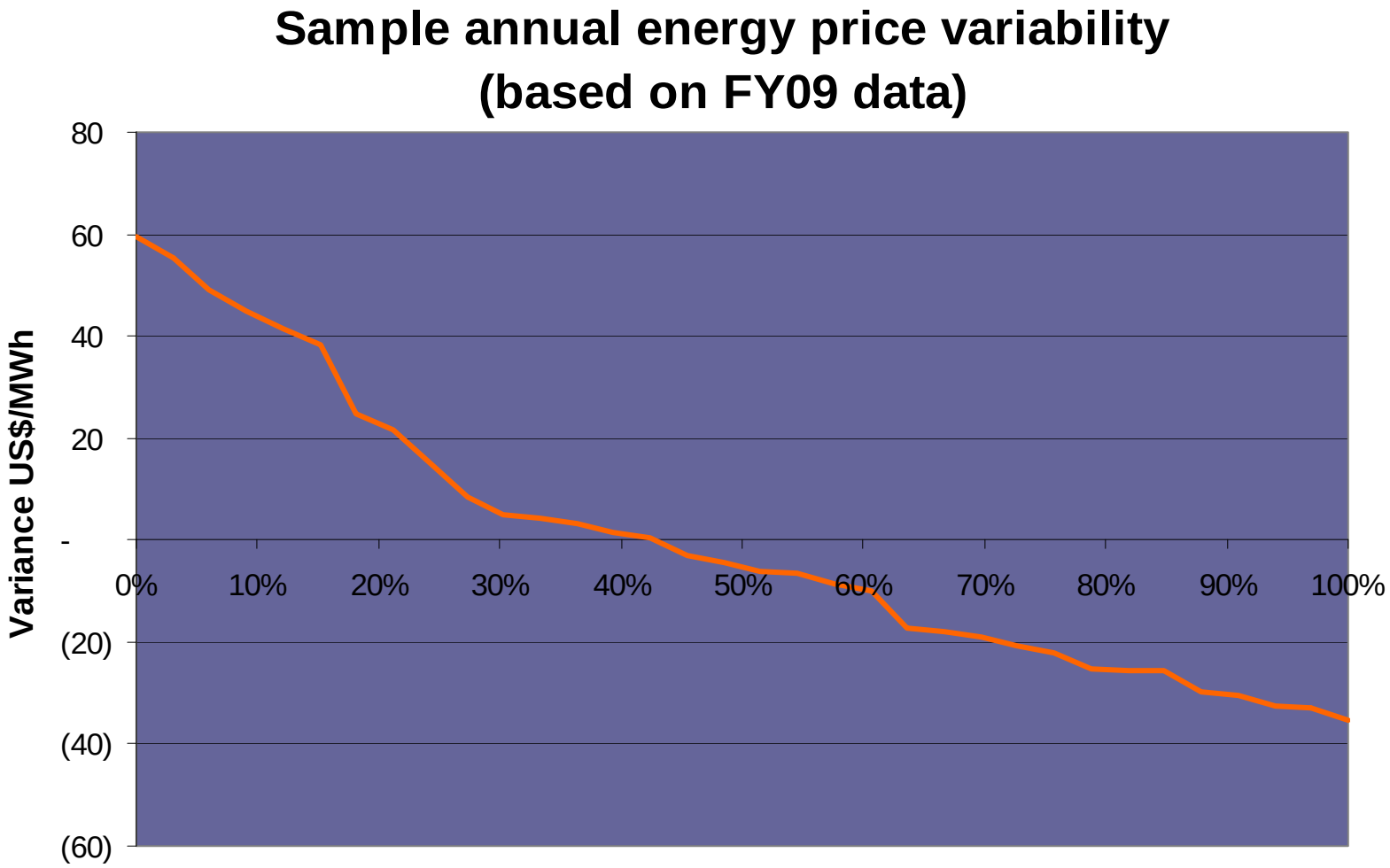
Why are we here?

- Agreed to hold a workshop on the domestic commodity risk management program
- Lay groundwork for risk management discussions at the next revenue requirement
- Discussion of risk management and its application to the domestic portfolio

Energy Portfolio



Energy Portfolio



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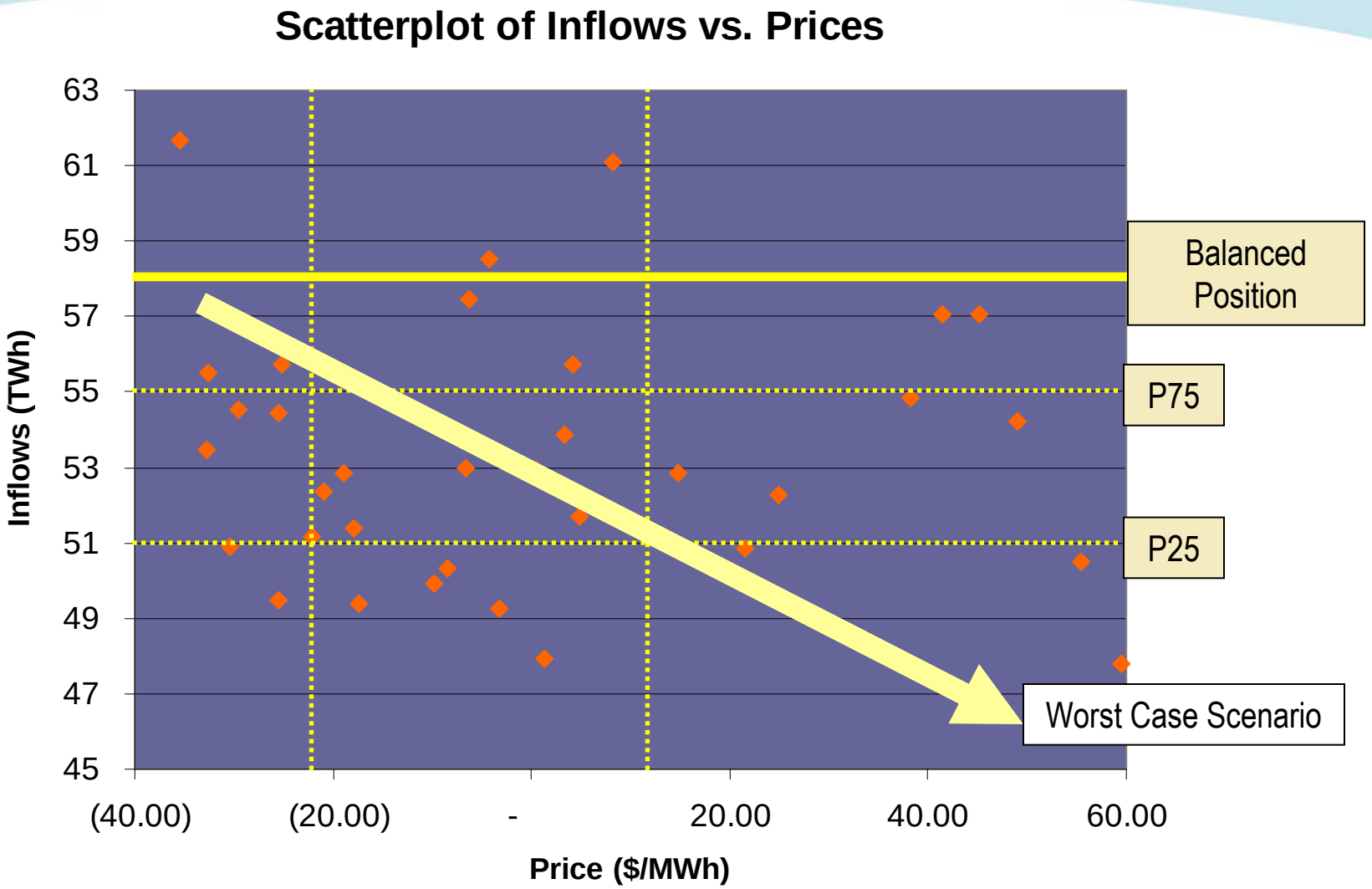

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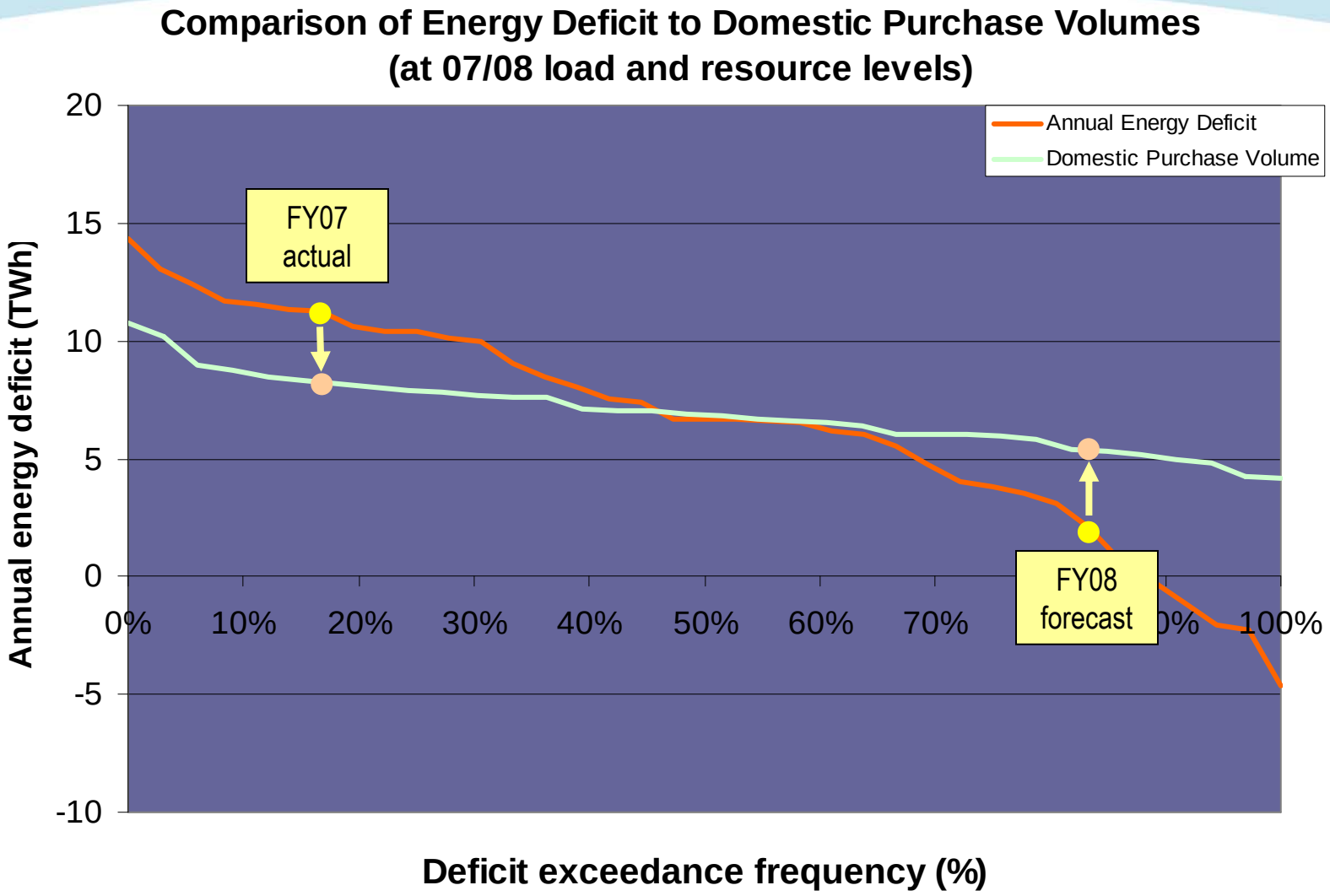
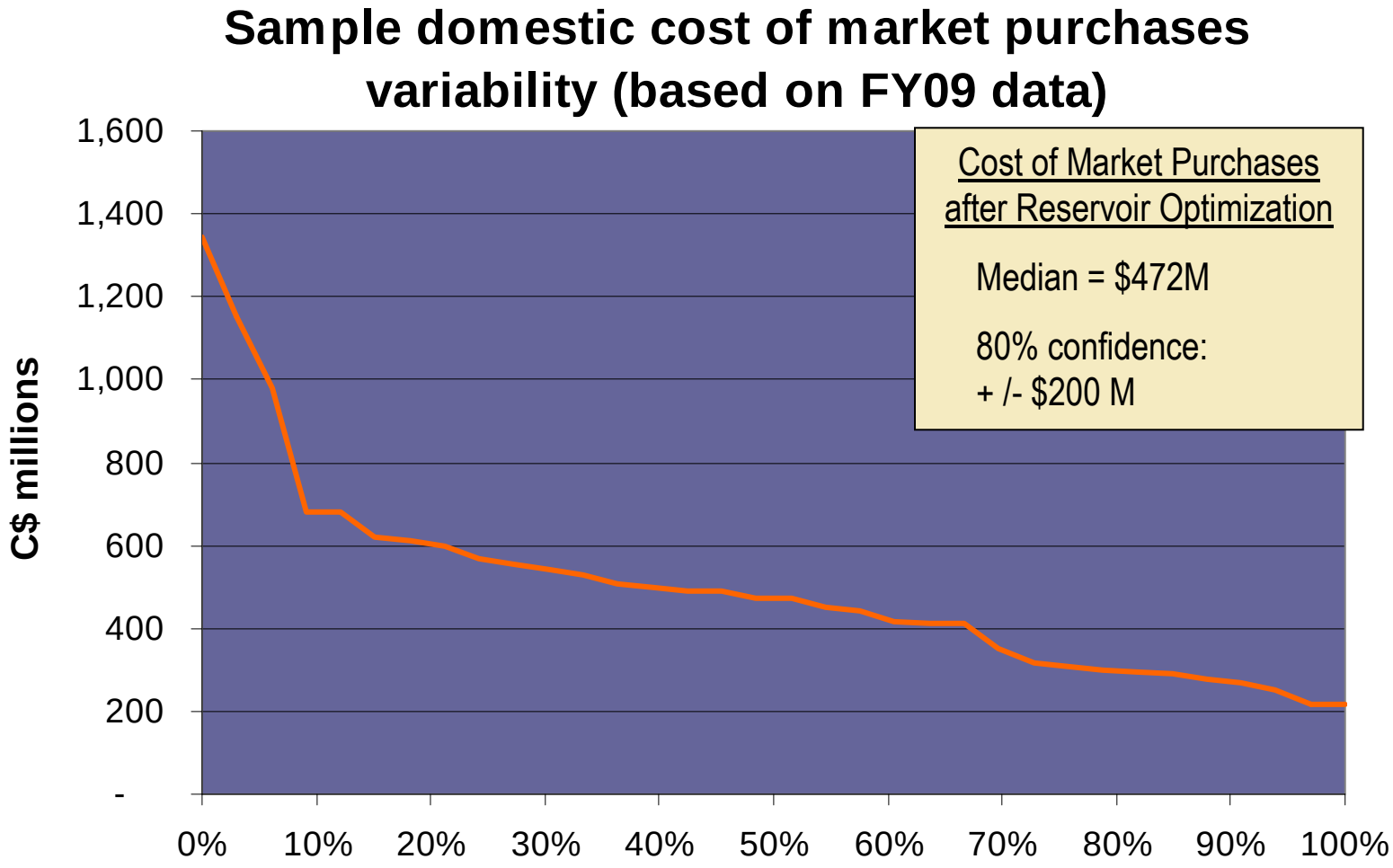
Risk Management

- Tools to manage risk associated with Cost of Energy
  - Reservoir Optimization
  - Deferral Accounts
  - Hedging

Risk Management



Risk Management



Risk Management

- We can optimize volume between years
- We can partially optimize volumes between seasons
  - i.e. typically purchase during freshet and shoulder/fall periods

Why can we only partially optimize?

- Strain placed on system due to significant short position and unit outages results in periods where BC Hydro is energy short and does not have the option to NOT purchase

SECTION 2

Risk Measurement

How do we measure risk?

Risk Management

What is risk management?

- Reduces fluctuations in outcomes
  - i.e. rate smoothing
- Exchanges uncertainty for certainty of outcomes
- Reduces both downside and upside
- Does not change the average long-term cost

Risk Drivers

Cost variation is determined by both price and volume

- Market prices are determined by both continental and regional factors
- Purchase volumes are determined by system optimization around system inflows

- Neither market prices nor system inflows are controllable by BC Hydro

Risk Definition

What is Risk?

- Estimate of potential variability
- In this context, risk is the variability in the domestic cost of market purchases
  - How much cost increases if prices go up or inflows go down,
  - “Worst case” possible cost
- Smoothness of rates

- Risk is difficult to quantify after the fact

Risk Definition

Risk is closely tied to probability

- Based on relative probability of possible cost outcomes

- System optimization modeling provides distribution of potential costs and volumes
- Analyze risk by looking at these cost distributions

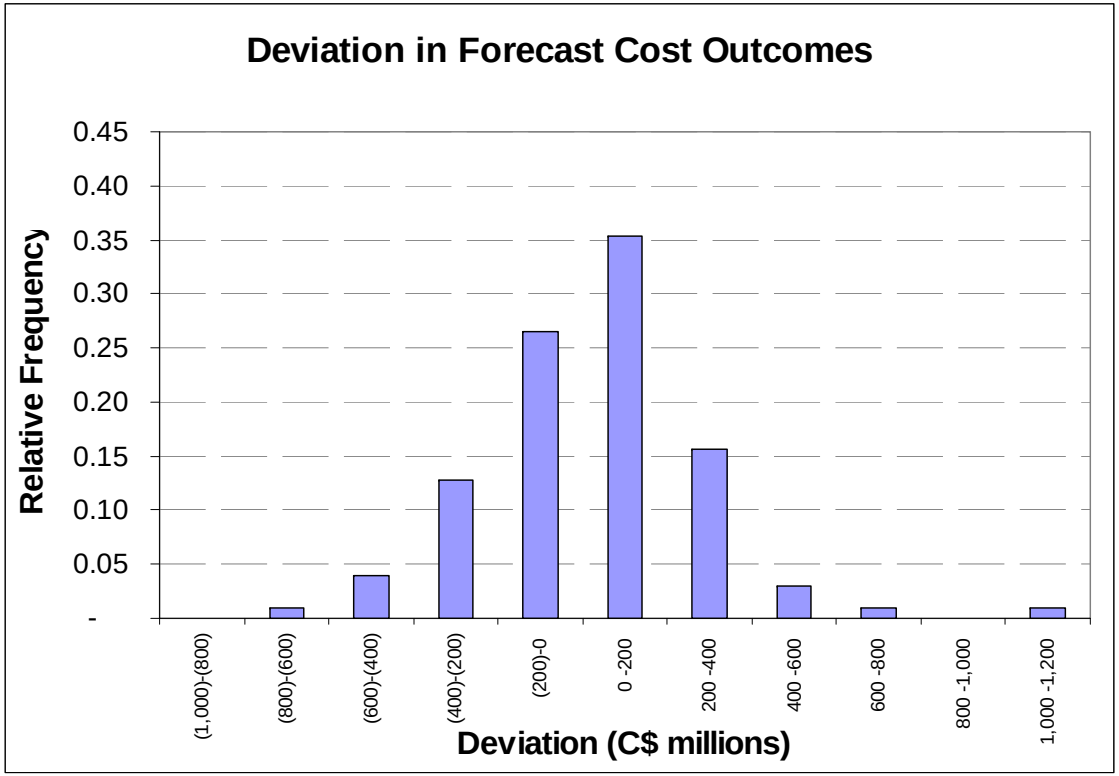
Risk Primer

How do we calculate risk?

- The cost of market purchases has significant variation, caused by fluctuations in market prices, system inflows, and other factors

Cost of Purchases

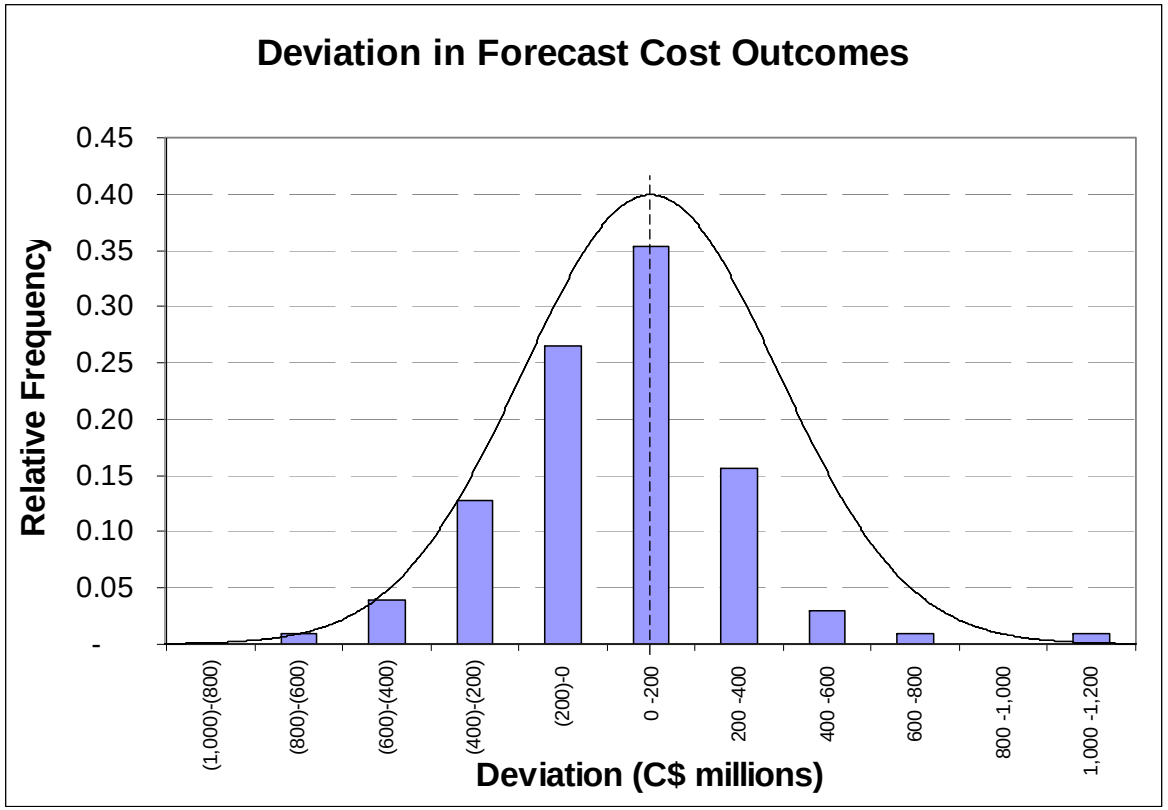
Sim	Deviation
1	68
2	(242)
3	40
4	338
…	…
97	(25)
98	7
99	163
100	107



Risk Primer

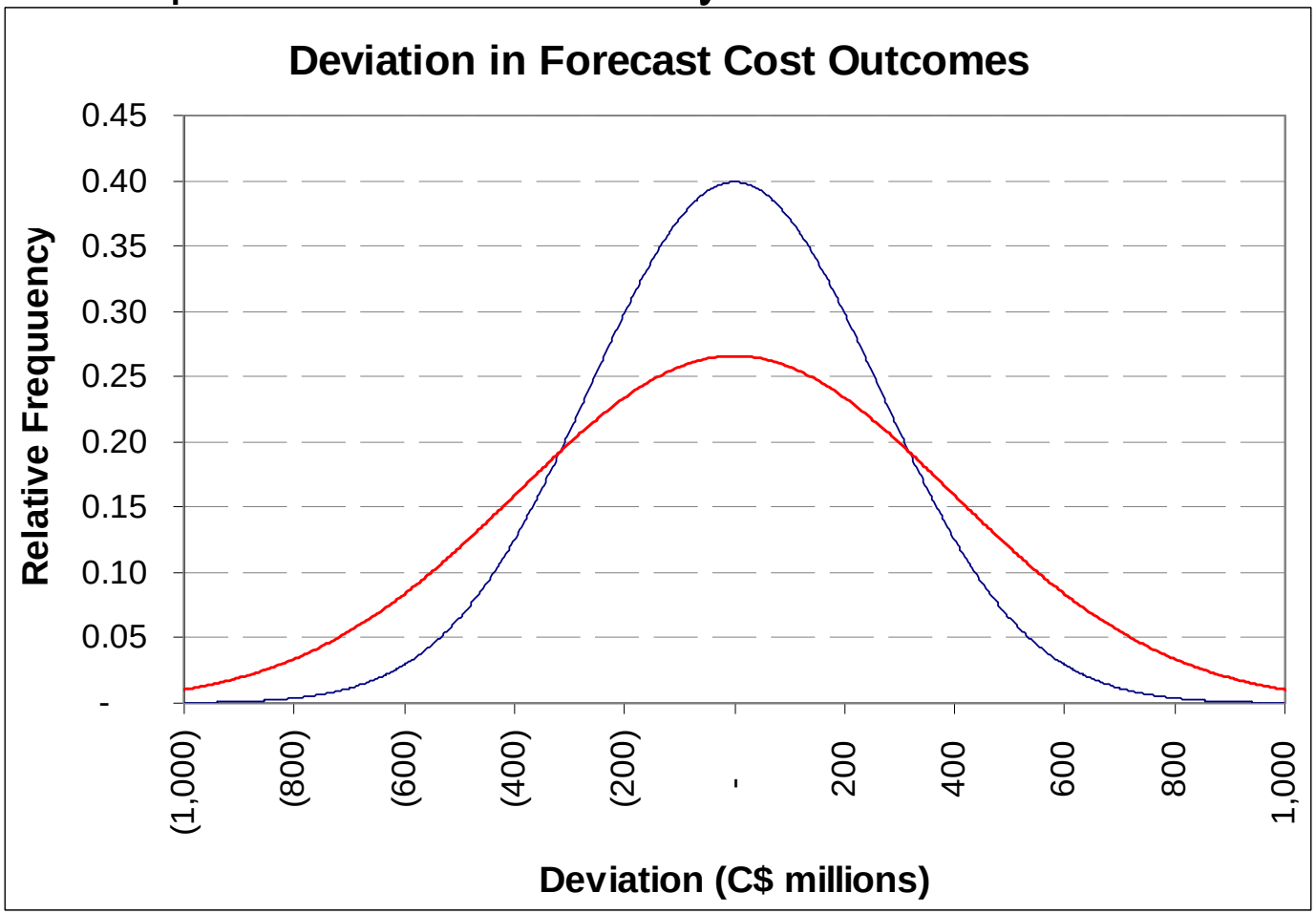
How do we calculate risk?

- Look at basic cost distribution



Risk Primer

Can compare risk levels visually



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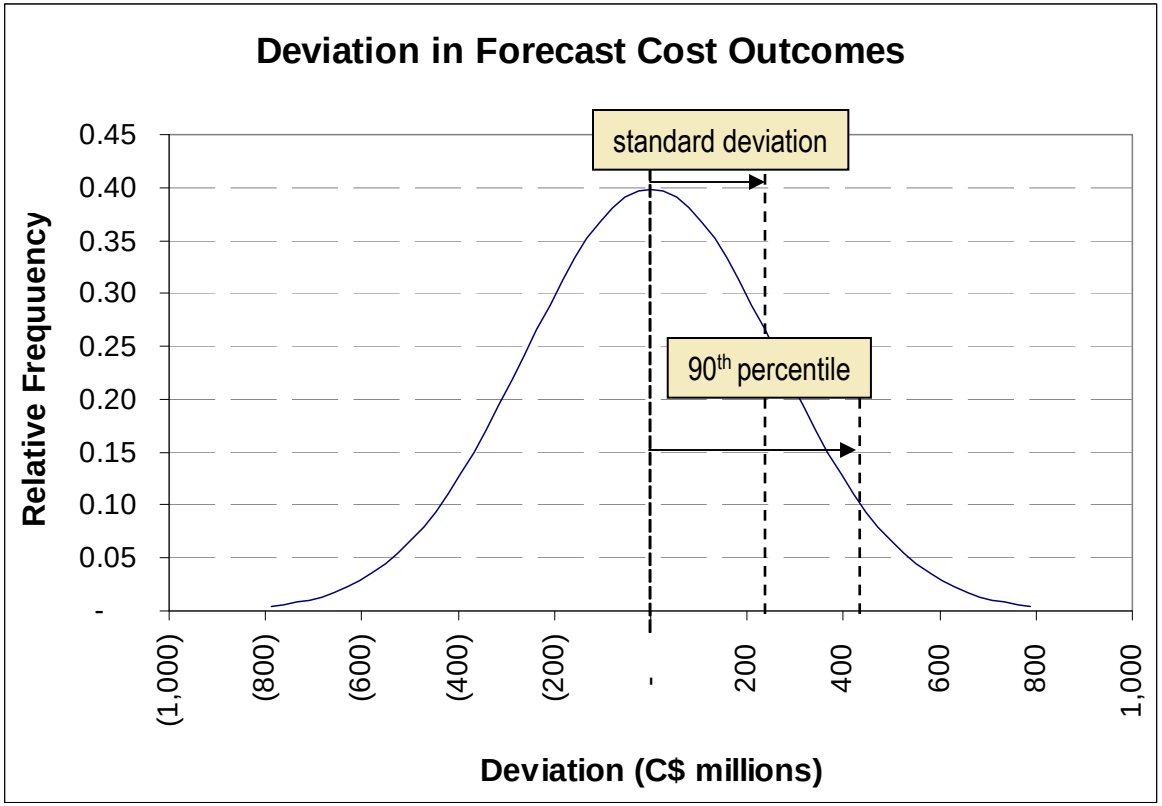
Risk Primer

How do we calculate risk?

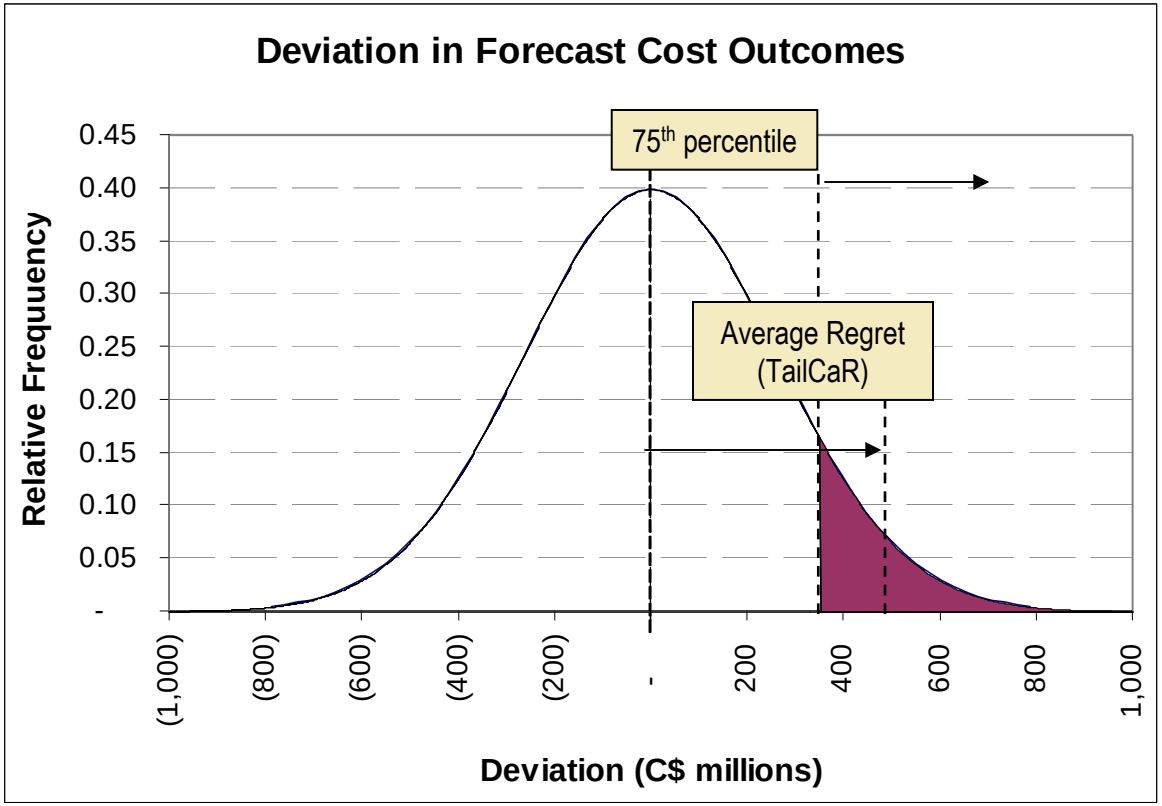
- Basic variability measures



Risk Primer

For most of this presentation, will focus on Tail Cost-at-Risk (TailCaR)

- TailCaR is a measure of "average outcome" in the worst 25% of cost scenarios



Asymmetry in Risk Outcomes

- TailCaR is useful due to the asymmetry in drivers of cost of market purchases

- Prices are bound on the lower end, but have nearly unlimited upward mobility
- Inflows are bound on the high side due to the finite size of our reservoirs, but have effectively unlimited downside
- Both these asymmetries are negative to BC Hydro – the unlimited side of the risk increases the cost of market purchases

Risk Measurement

- On average, the annual domestic cost of market purchases has a top-quartile regret (TailCaR) of $200-300M

- Multi-year risk is NOT additive – reservoirs act as stabilizing factor

Top Quartile TailCaR (by period)				
Year 1	Year 2	Year 3	Years 1-2	Year 1-3
250	250	250	480	600
		Summed Regrets	500	750

Risk and Time Periods

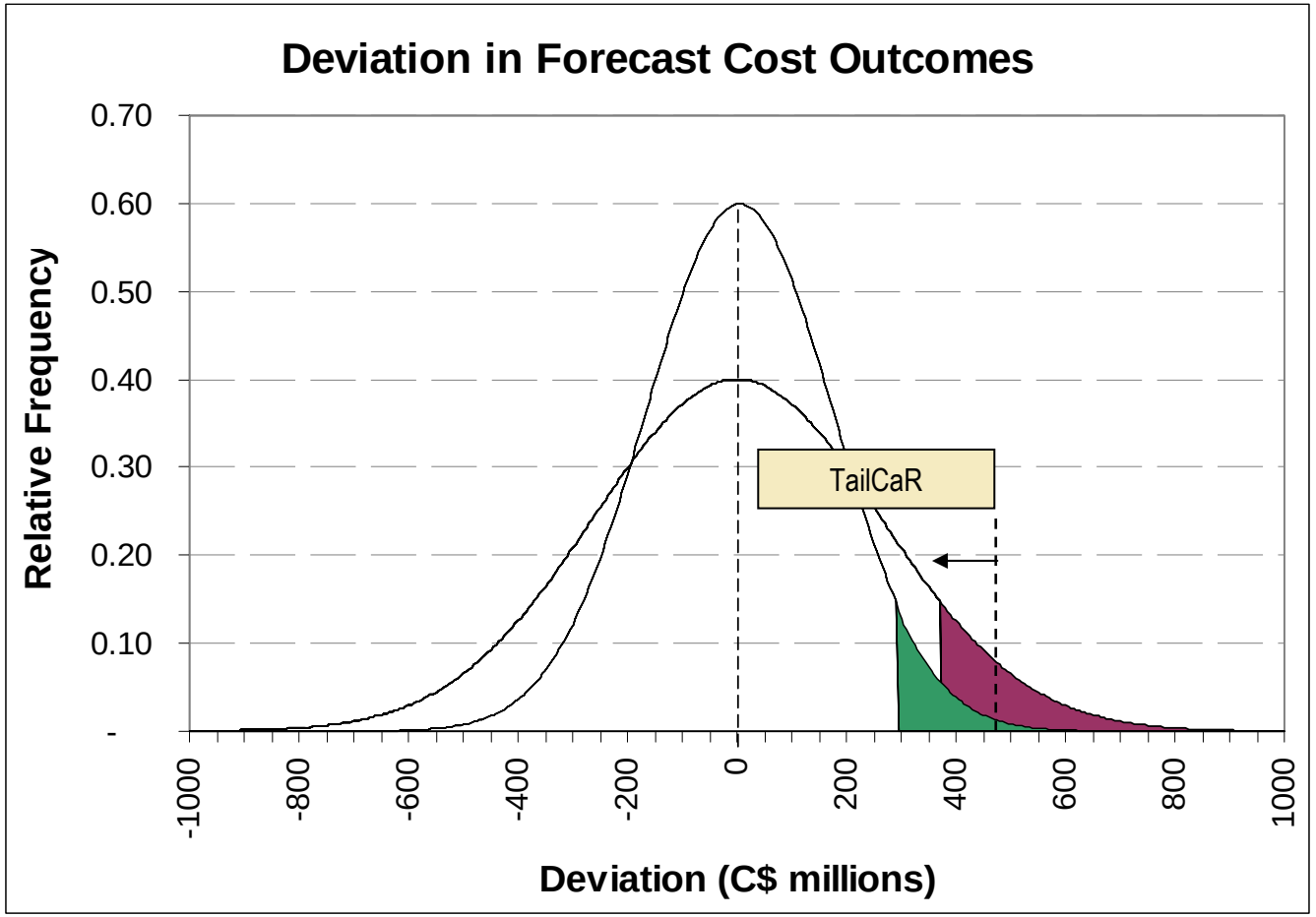
Risk metric depends significantly on the time period

- Single-year risk
  - Storage reservoirs act as a partial hedge
  - All of variability is absorbed by deferral accounts

- The risk to the cost of market purchases in a single year is NOT the risk seen by the ratepayer
  - Need to look at 2-3 year timeframe

Risk Management

- Purpose is to reduce variability in cost of energy



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SECTION 3

Risk Benefit Analysis

Do Hedges Reduce Risk?

Risk Benefit Analysis

Does the Domestic hedging program reduce risk to ratepayers?

- To answer, use a simplified cost distribution to demonstrate risk benefits
- Simulation based on relationships between BC Hydro cost of market purchases and market prices
- Compare TailCaR in cost of market purchases
  - before and after deferral accounts, and
  - with and without hedging

Risk Scenario – no deferral accounts

Simulate rate variability under specific assumptions

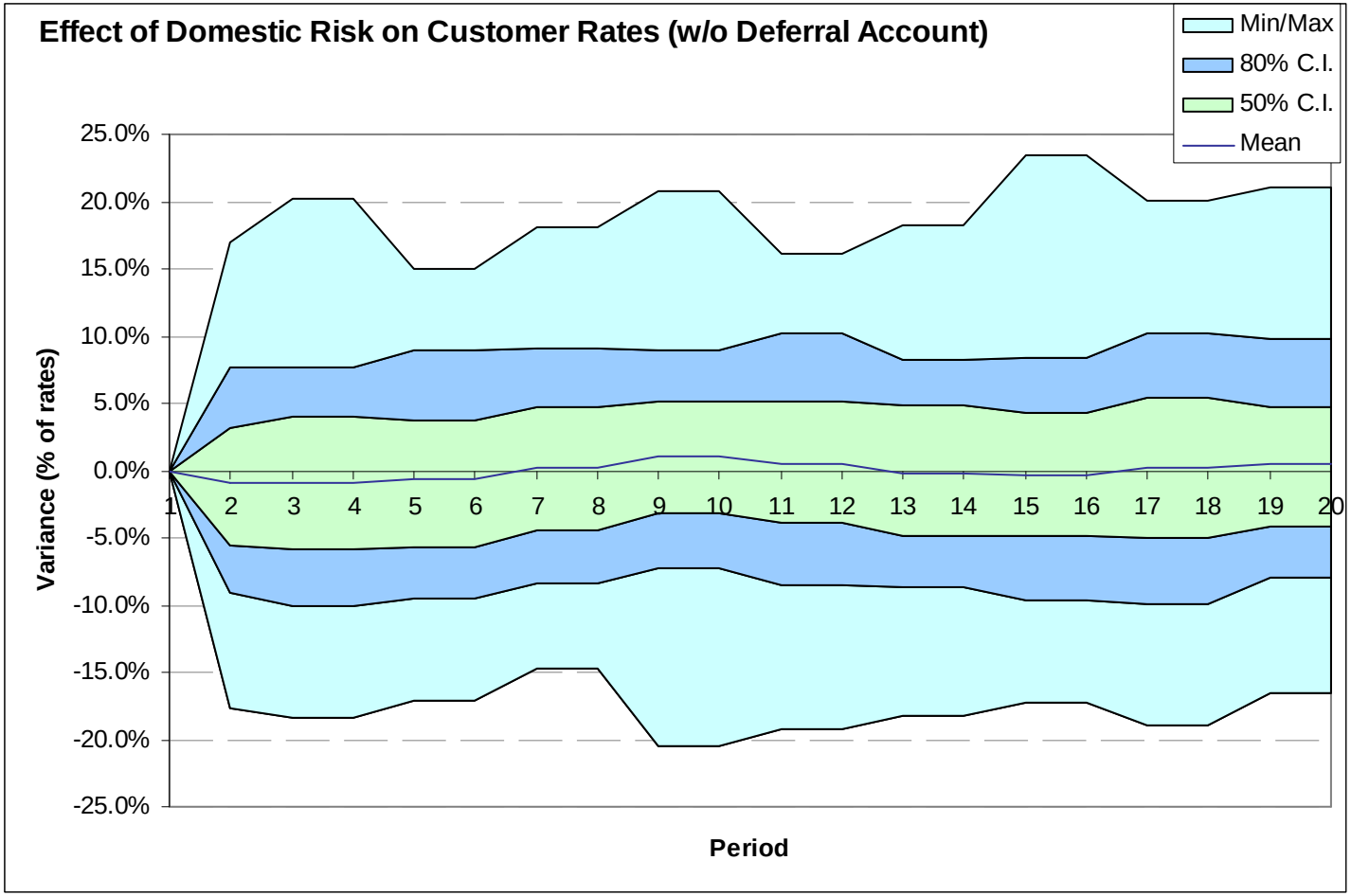
- 2-year RRA period
- 5-year deferral account clearing period
- $25M cost increase equals 1% rate increase

Single Simulation

Year	Cost Variance	Deferral Account	Rate Rider
0		-	
1	70.0	70.0	0.0%
2	46.0	116.0	0.0%
3	(103.9)	(11.1)	0.9%
4	77.6	43.3	0.9%
5	116.9	162.5	0.3%
6	46.7	200.5	0.3%
…	…	…	…

Risk Scenario – no deferral accounts

Risk without deferral accounts – variability flows through directly



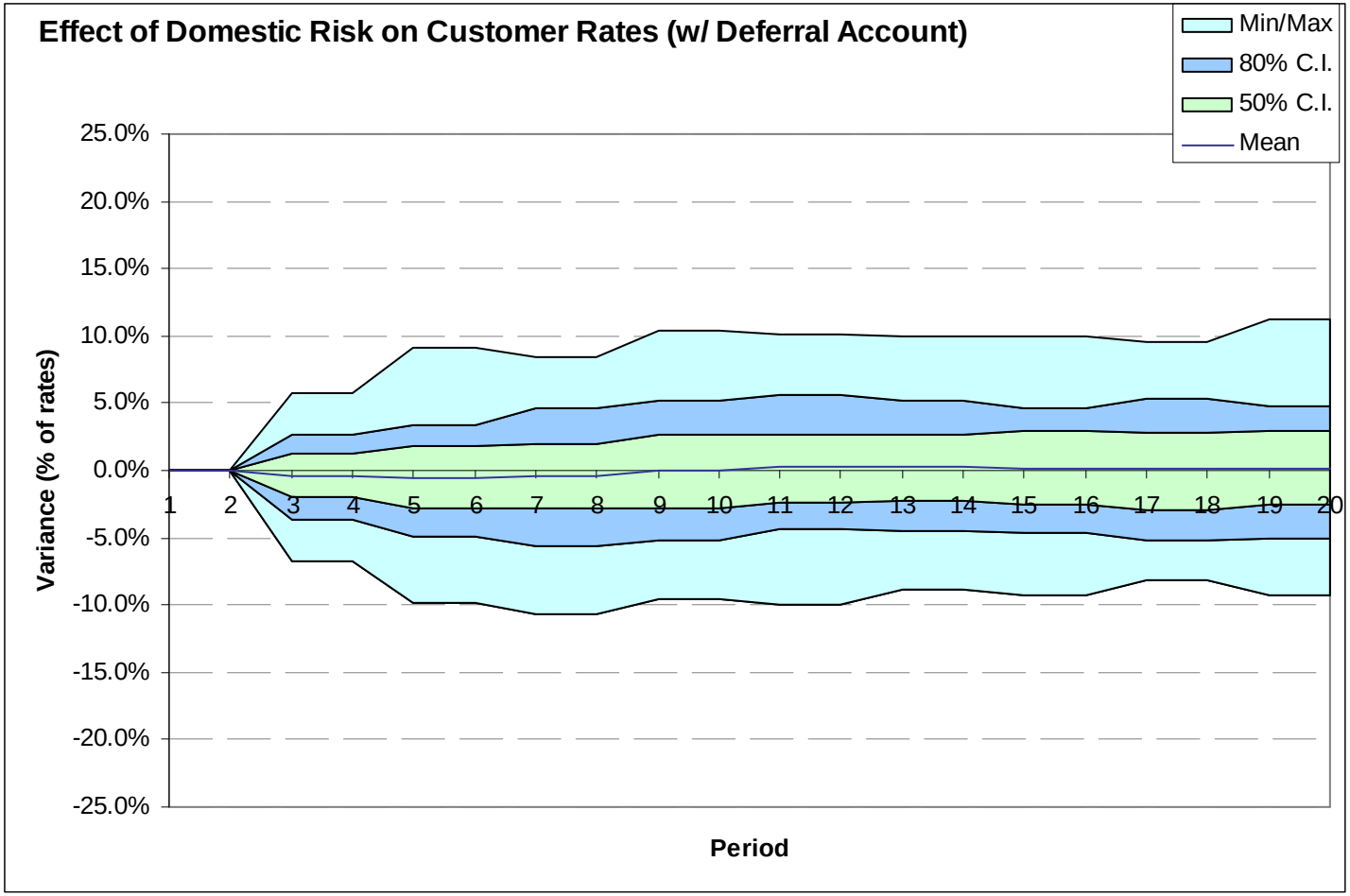
TailCaR = $ 5.7 /MWh
= 8.8% rate
= $ 220 MM

Assumes:

- $25M cost increase equals a 1% rate increase

Risk Scenario – w/ deferral accounts

Risk with deferral accounts – reduced rate impact



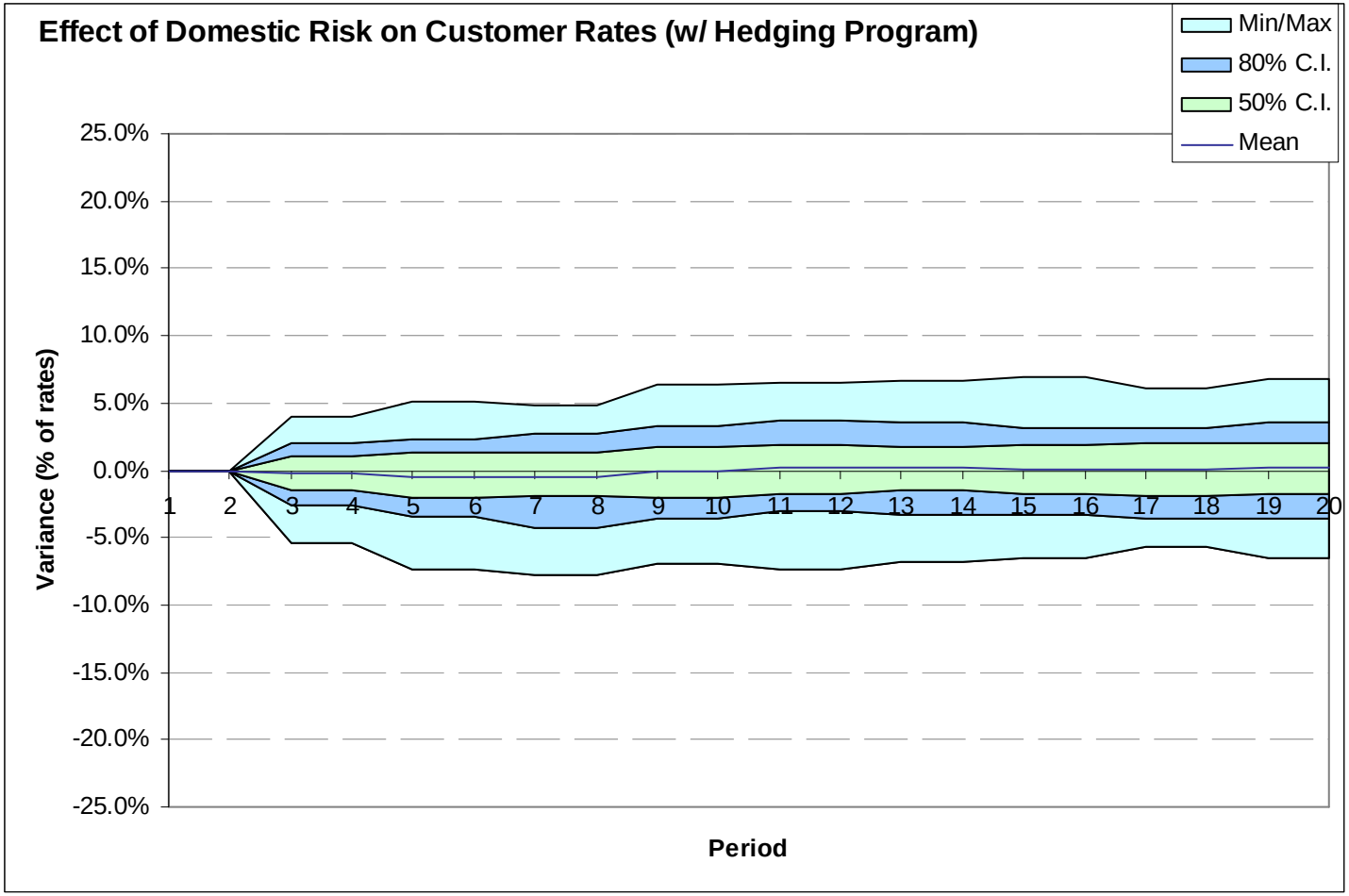
TailCaR = $ 2.8 /MWh
= 4.3% rate
= $ 108 MM
= 51% reduction

Assumes:

- 2-year RRA period
- 5-year deferral account clearing period

Risk Scenario – w/ hedging program

Risk with hedges – further risk reduction



TailCaR = $ 1.9 /MWh
= 2.9% rate
= $ 73 MM
= 67% reduction
vs. 51% unhedged

Assumes:

- 50% of purchases hedged

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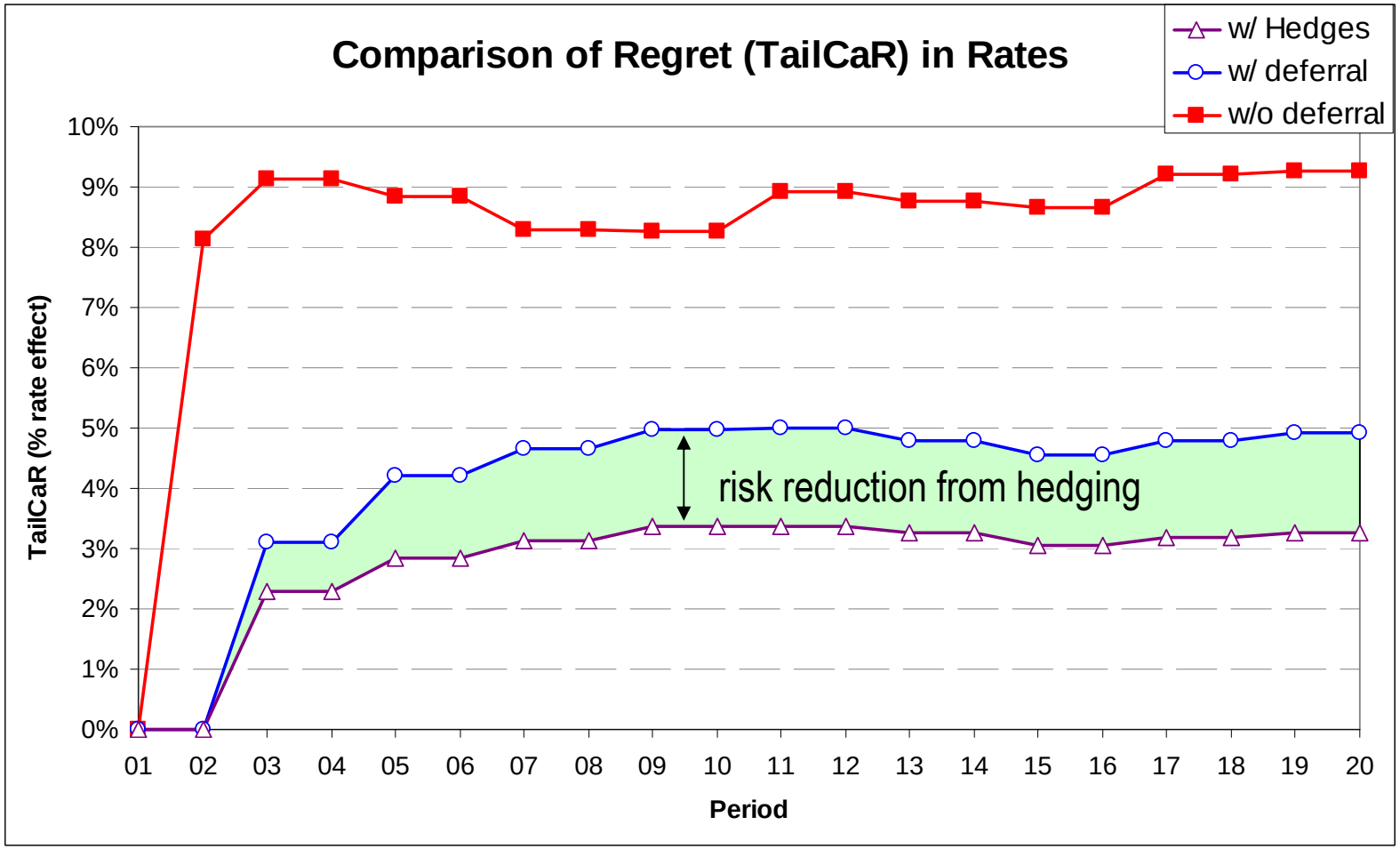
Risk Benefit Analysis

Based on simulation, hedging program reduces long-term rate risk



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Risk Benefit Analysis

- Hedging more of the domestic portfolio would reduce volatility further
- However, there is a maximum risk reduction possible
  - This is due to volumetric variability
- At some volume of hedges, the hedged position will become more risky that the base position
  - At this point hedging is actually increasing risk

Cost Shock Reduction

While program provides risk reduction for "normal" variability, further value provided under a long-term price shock

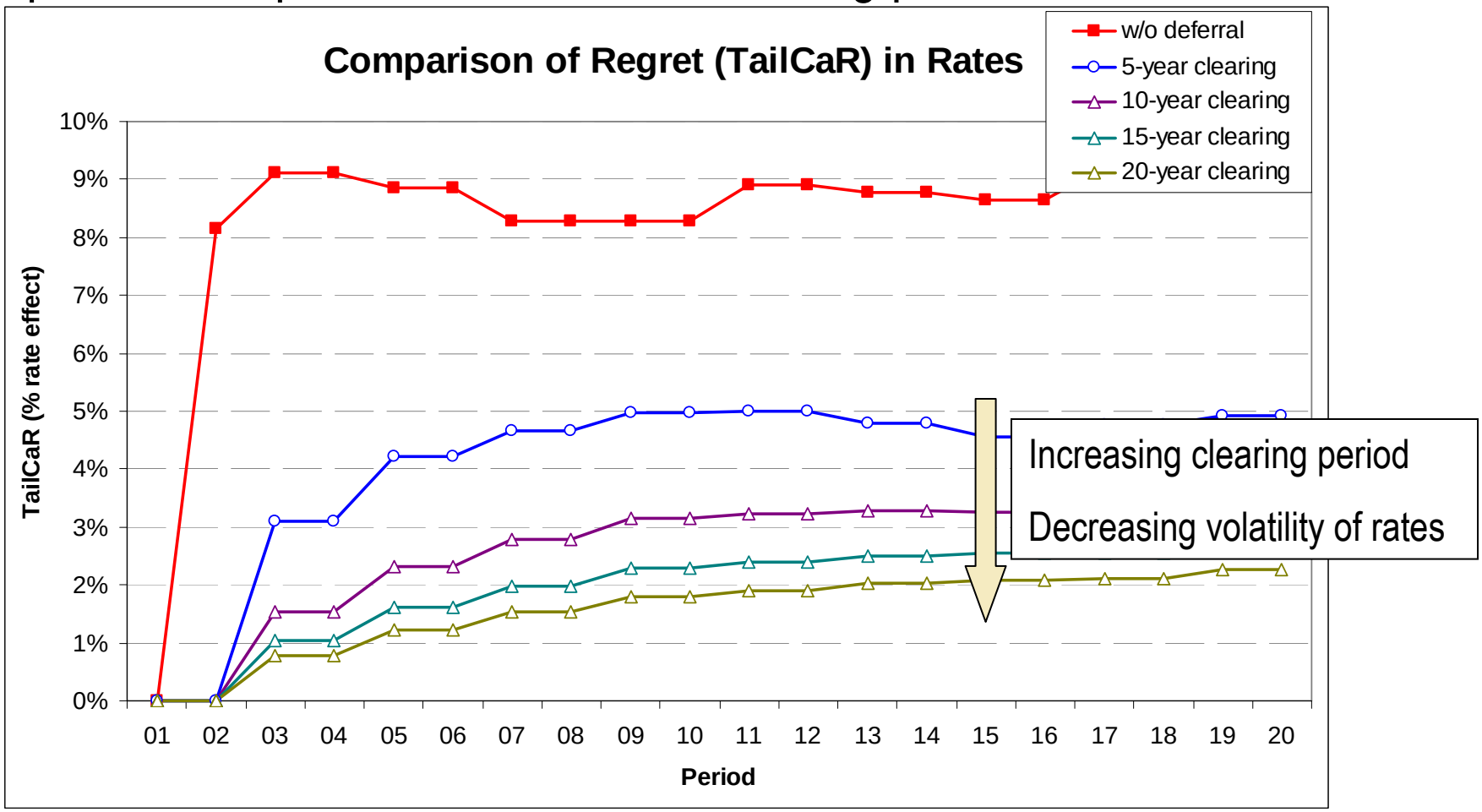
- Important due to asymmetry of cost outliers

Cost of Market Purchases (Apr07-Mar09)

		Mean	Worst Sequence	Delta	Rate Effect (%)
Cost	(C$ mil.)	822	1,808	986	7.9%
Market Price	($/MWh)	72.63	121.75	49.12	
(assume 50% hedged)					
MTM Gains	(C$ mil.)	-	344	344	2.8%
Hedged Cost	(C$ mil.)	822	1,465	642	5.1%

Alternatives

Impact of sample deferral account clearing periods



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SECTION 4

Review of Current Policy

Commodity Risk Management Policy
for short term domestic obligations (Feb 2005)

Policy Objective:

- Reduce risk associated with the cost of energy

Key Content:

- Period: up to 3 years
- Requirements/Roles/Responsibilities
- Commodities: Electricity and Natural Gas
- Criteria for Risk Mitigation

Electricity Hedging under CRMP

Criteria:

- Instruments limited to financial products
- Product shall be below the domestic buy price
- Permissible volume range defined (percentage of expected imports)

Electricity Hedging

Allowable Volume Range

(Percentage of Expected Imports)

Months from current	1-12	13–24	25 – 36
Low Res.	25–50%	0–25%	0 – 25%
High Res.	0–25%	0–25%	0 – 25%
Expected Sales	15–50%	--	--

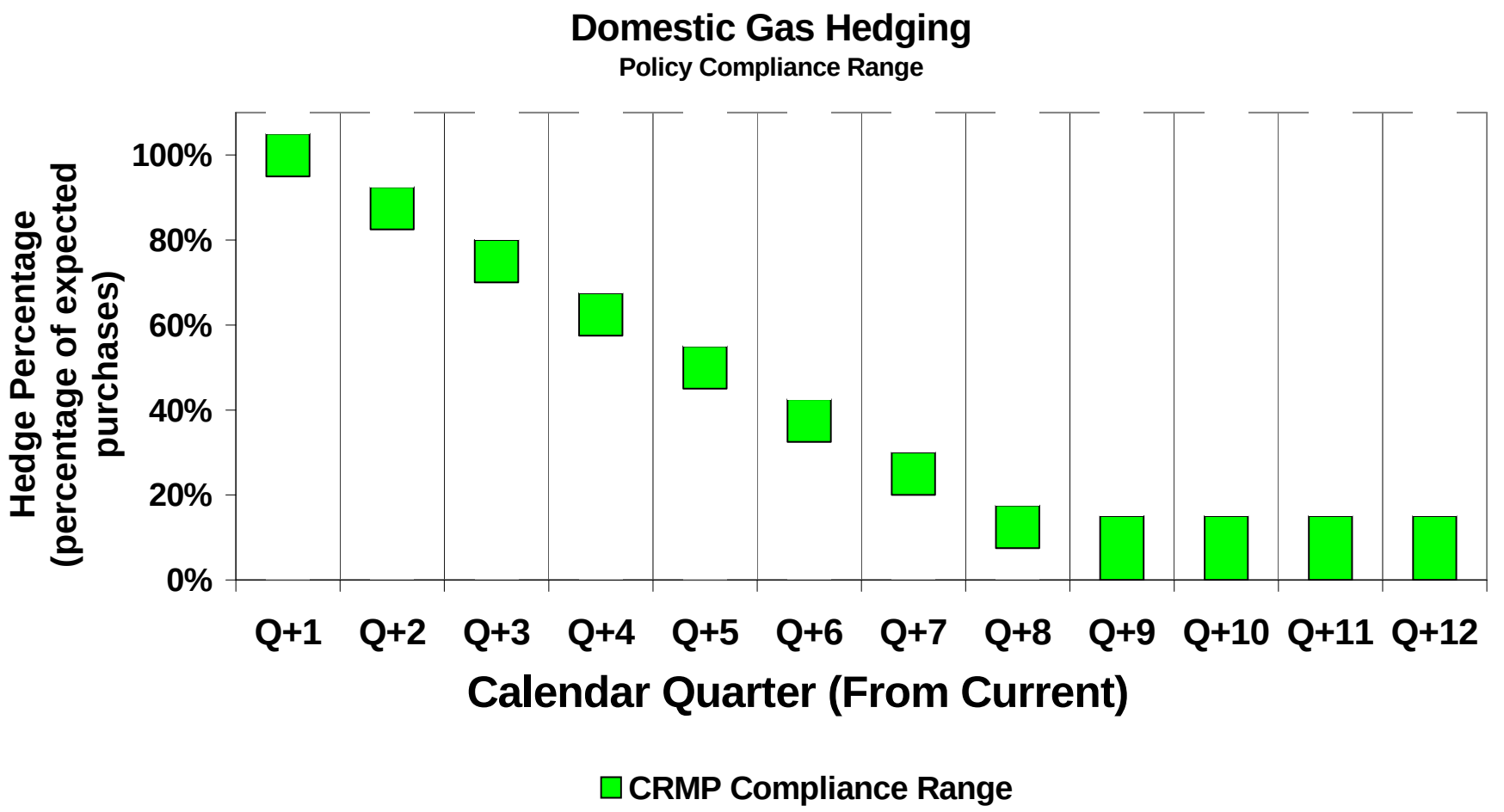
- Significant flexibility in Electricity Hedging:
  - Target periods of elevated risk
  - To take advantage of knowledge of Pacific Northwest system.
  - To adapt to changing conditions

Gas Hedging under CRMP

Criteria:

- Mechanistic approach, within tight bounds
- Quarterly Timesteps
- Percentage of Expected Volume:
  - Must-run
  - Low heat rate
- Position has linear volume reduction out to 2 years

Electricity Hedging

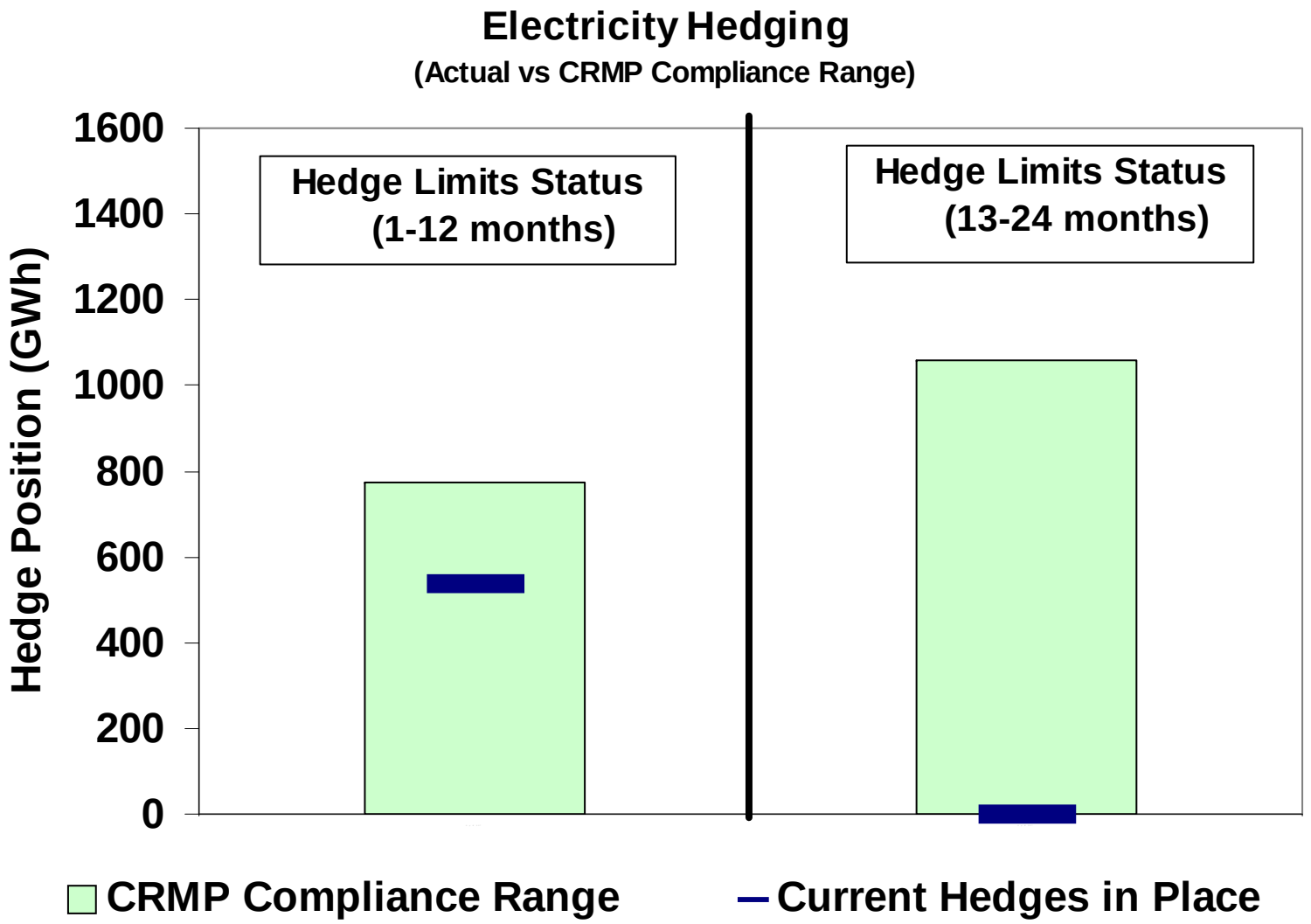


Hedging has been discontinued as per Negotiated Settlement

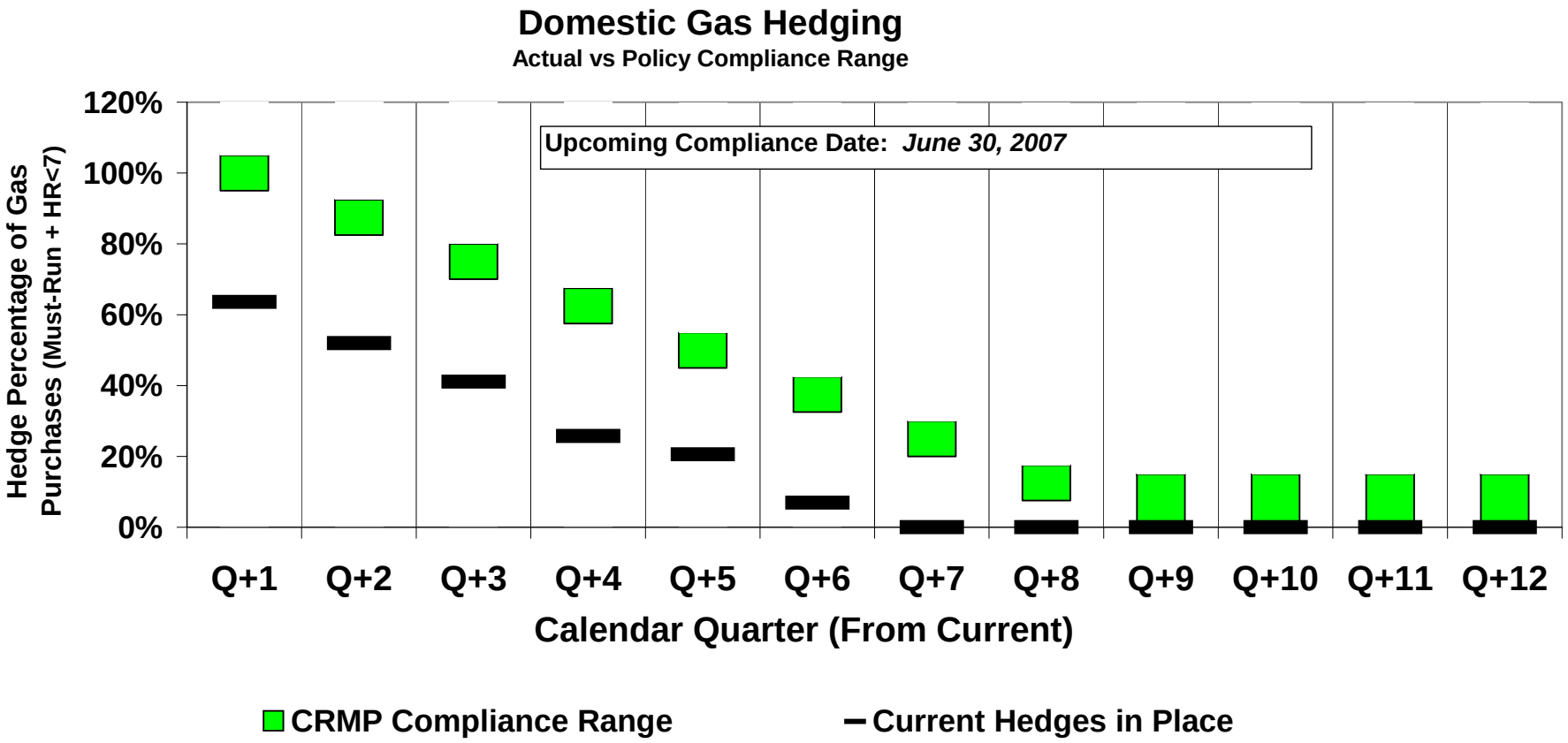
Performance of BC Hydro hedges

- Analysis of actual position (April 1, 2007)
  - Looking forward at Risk Reduction
- Retrospective look at Mark-to-Market dynamics

April 1 : Electricity Hedges



April 1 : Gas Hedges



April 1 : Risk Portfolio

TailCaR Risk Reduction: Position as of April 1, 2007

	% Hedged	No Deferral and Unhedged (% rate)	Deferral and Unhedged (% rate)	Deferral & Hedged (% rate)	% Delta
FY08-09 (Actual)	14%	14.4%	2.90%	2.60%	-10%
FY08-09 (Optimal)	37%			2.00%	-31%

- Assumed 5 year deferral clearing
- Benefit of April 1 hedge position (no additional hedges added)
- As gas hedges continue to expire:
  - Hedged percentage will decrease
  - Risk will approach unhedged TailCaR

Mark-to-Market Results

- Overriding objective is to reduce the variability of the cost of market purchases
- Mark-to-Market in an unbiased market:
  - Long term MtM gains/losses near zero
  - Individual years may be significantly negative or positive

Electricity – Discretion vs Mechanistic

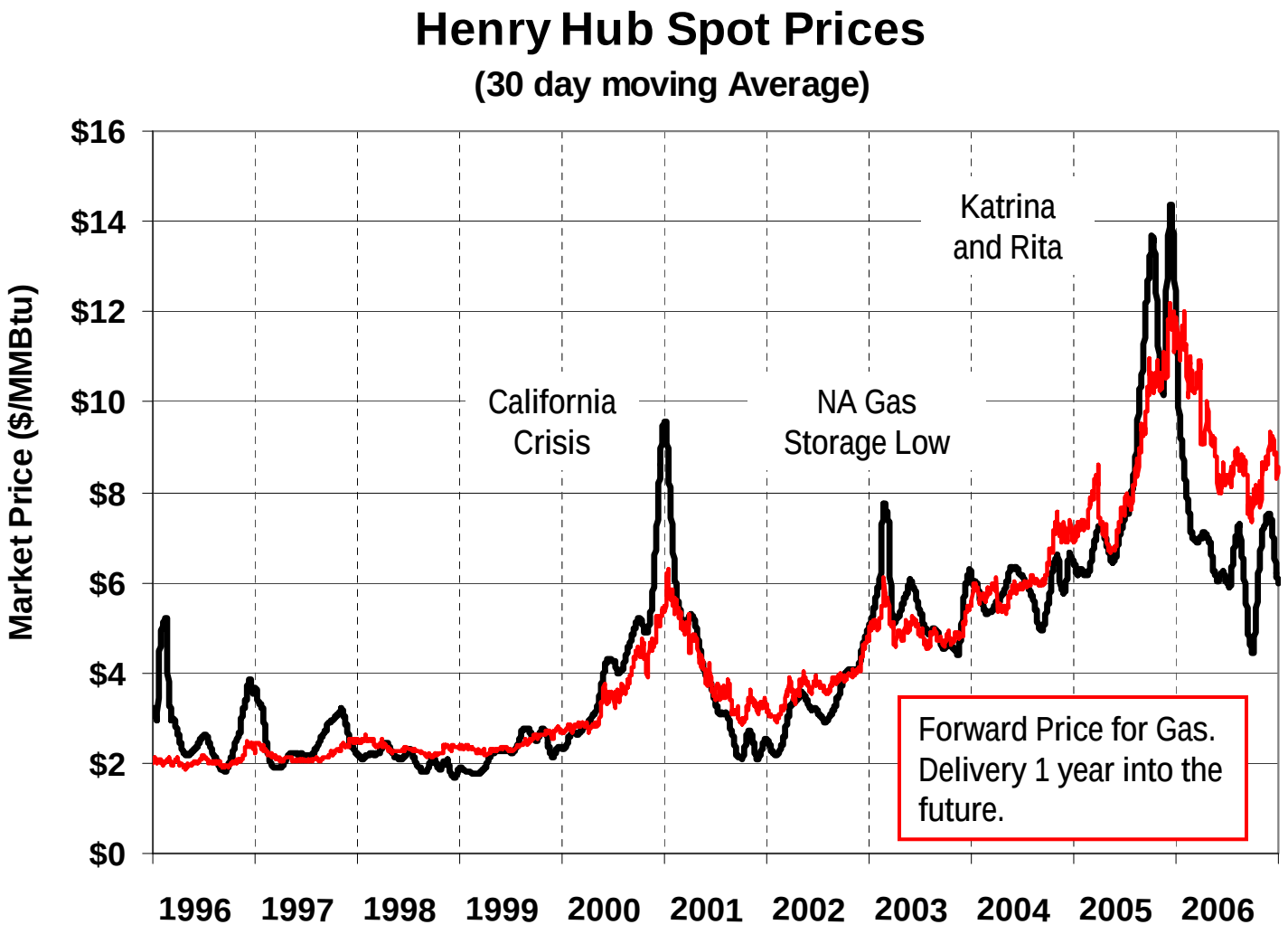
Fiscal	MtM	Mech.Strat	Δ
FY05:	+$27.0M	---	---
FY06:	-$37.5M	- $53.1M	+$15.6M
FY07:	+$5.6M	-$11.5M	+$17.1M
FY08 (Apr):	+$8.5M	+$12.1M	-$3.6M

Gas Mark-to-Market

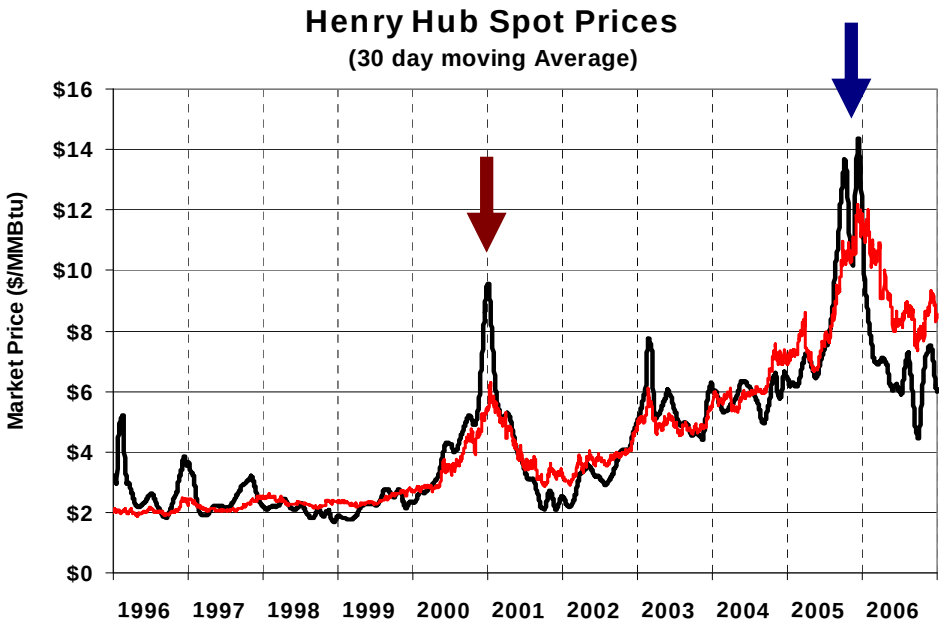
Fiscal	MtM
FY05:	+$7.0M
FY06:	-$3.0M
FY07:	*-$24.5M*

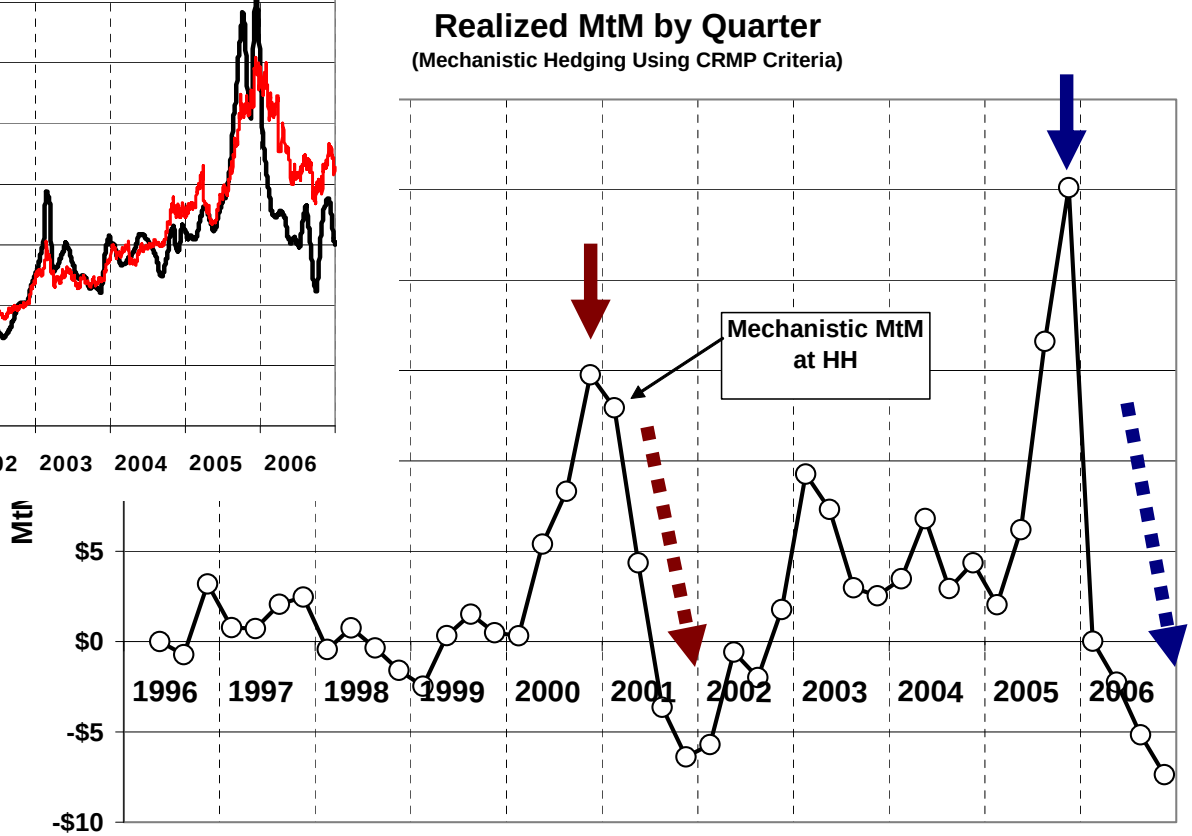
- Reflecting on recent performance:
  - Reviewed Henry Hub data: 1996 – 2006
  - Modeled MtM using CRMP mechanistic logic.

Mark-to-Market Simulation



Mark-to-Market Simulation





MtM Gain (1996-2006):

~US$10M/yr

Cost Component: Administrative

Domestic hedging program resources

- Staffing costs
  - Approximately 2 full-time equivalents (FTE)
    - Portfolio Manager (implementation)
    - Accounting
    - Management oversight
- Other costs
  - Energy Studies Modeling system supports hedging program

Cost Component: Bid-Offer Spread

- Transaction cost associated with Bid-Offer spread is considered small.
  - Most transactions will be buy and hold (limited churning)
  - BC Hydro will tend to avoid transactions that have wider bid-offer spreads
  - Bid-Offer spread will also exist on day markets

Cost Offsets

- Discretionary transactions provide net positive return, relative to mechanistic strategy.

- Improved knowledge base on markets, transferable to System Operations Planning.

SECTION 5

Closing

Risk management

Risk management is a process under continuous change, defined by improving knowledge and understanding based on analytical tools, market products, changes in underlying situation (ie system position) and risk tolerance.

Questions?

Thank you for attending.