

Risks In Power Exports

Report on the Consultancy Assignment

By

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Energy Export in Manitoba Hydro

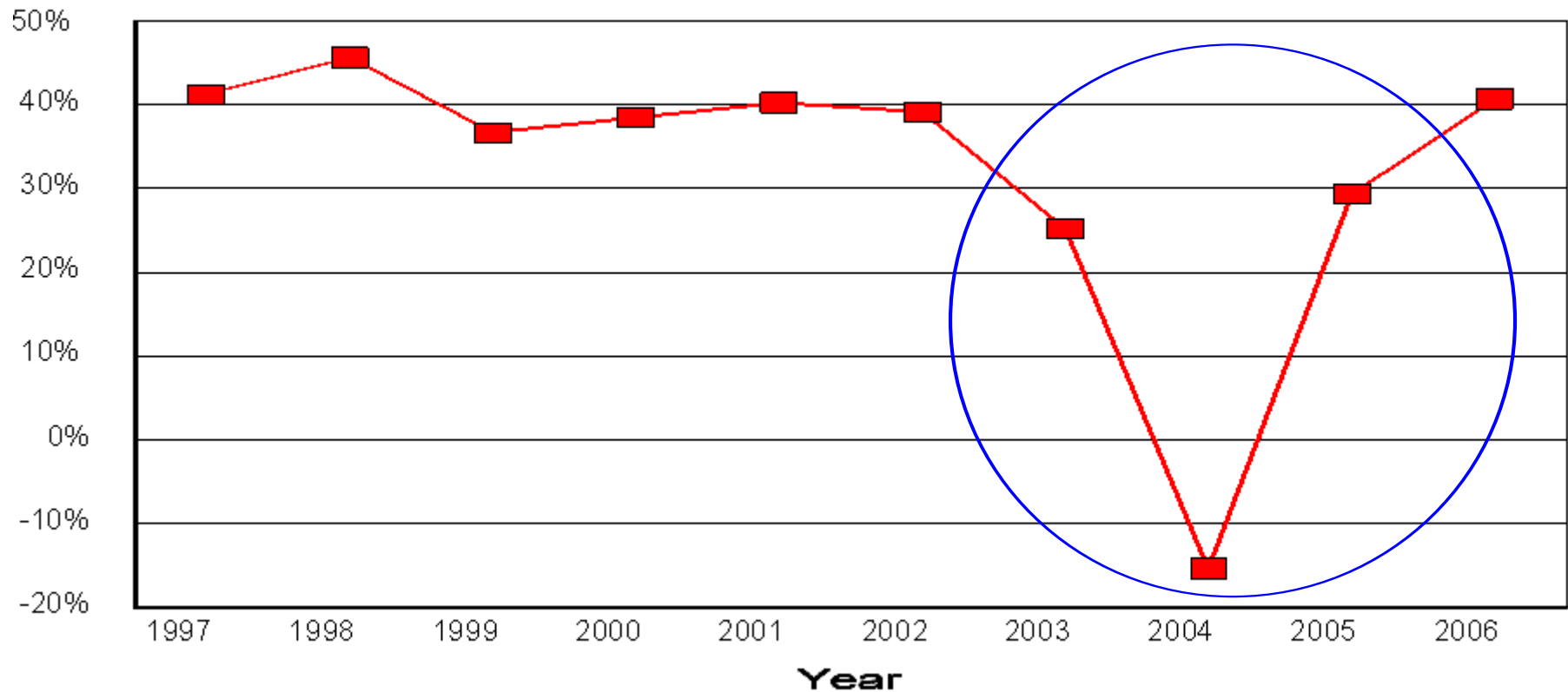
1997-2006

Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Total Energy Sold in GWh	27454	29348	25800	25726	27945	27869	25331	16745	27994	33682
Net Metered Export in GWh	11330	13399	9469	9906	11247	10911	6378	-2578	8213	13706
Export as a % of Total Energy sold	41%	46%	37%	39%	40%	39%	25%	-15%	29%	41%

Energy Export in Manitoba Hydro

1997-2006

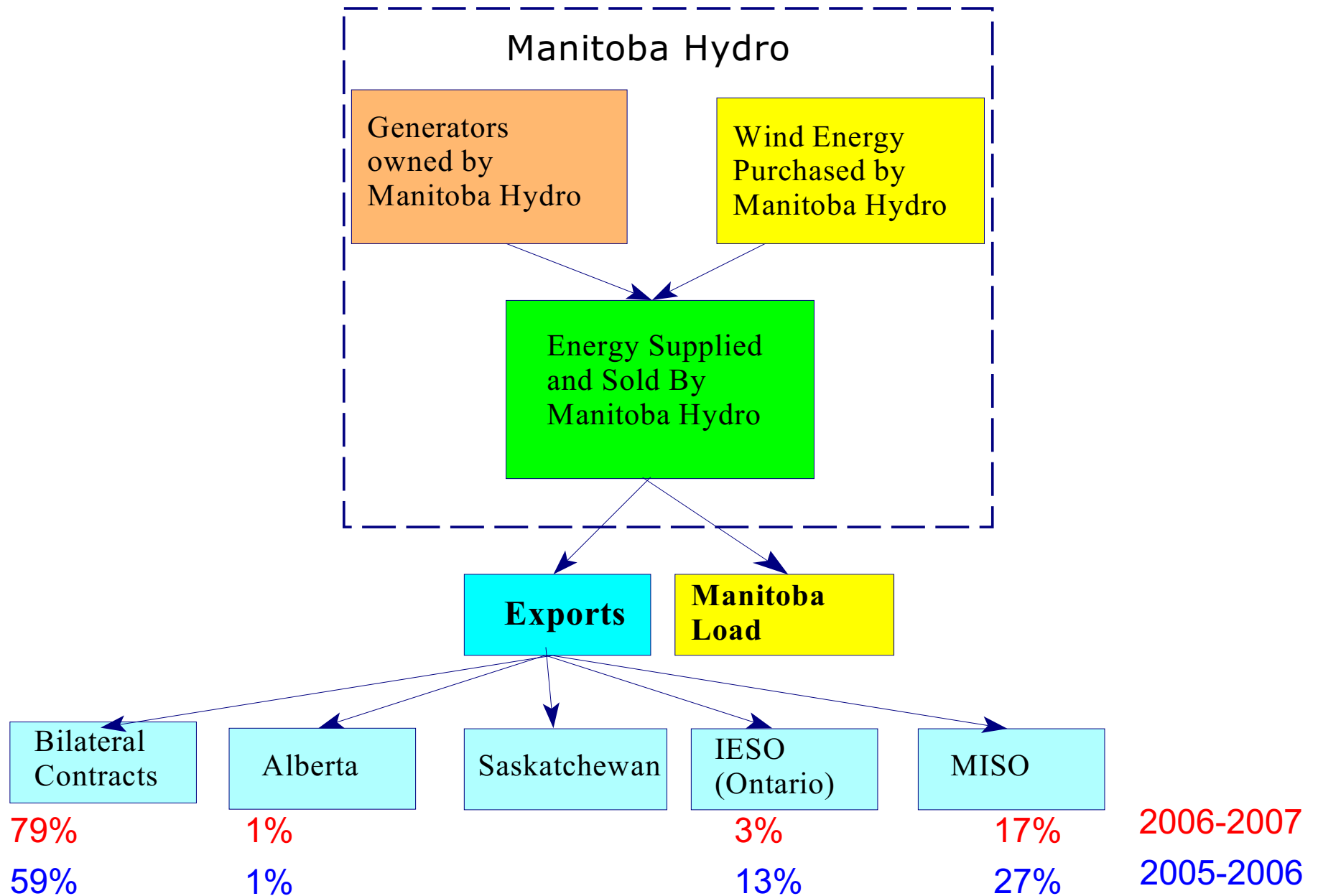
Export As % of Total Energy Sales



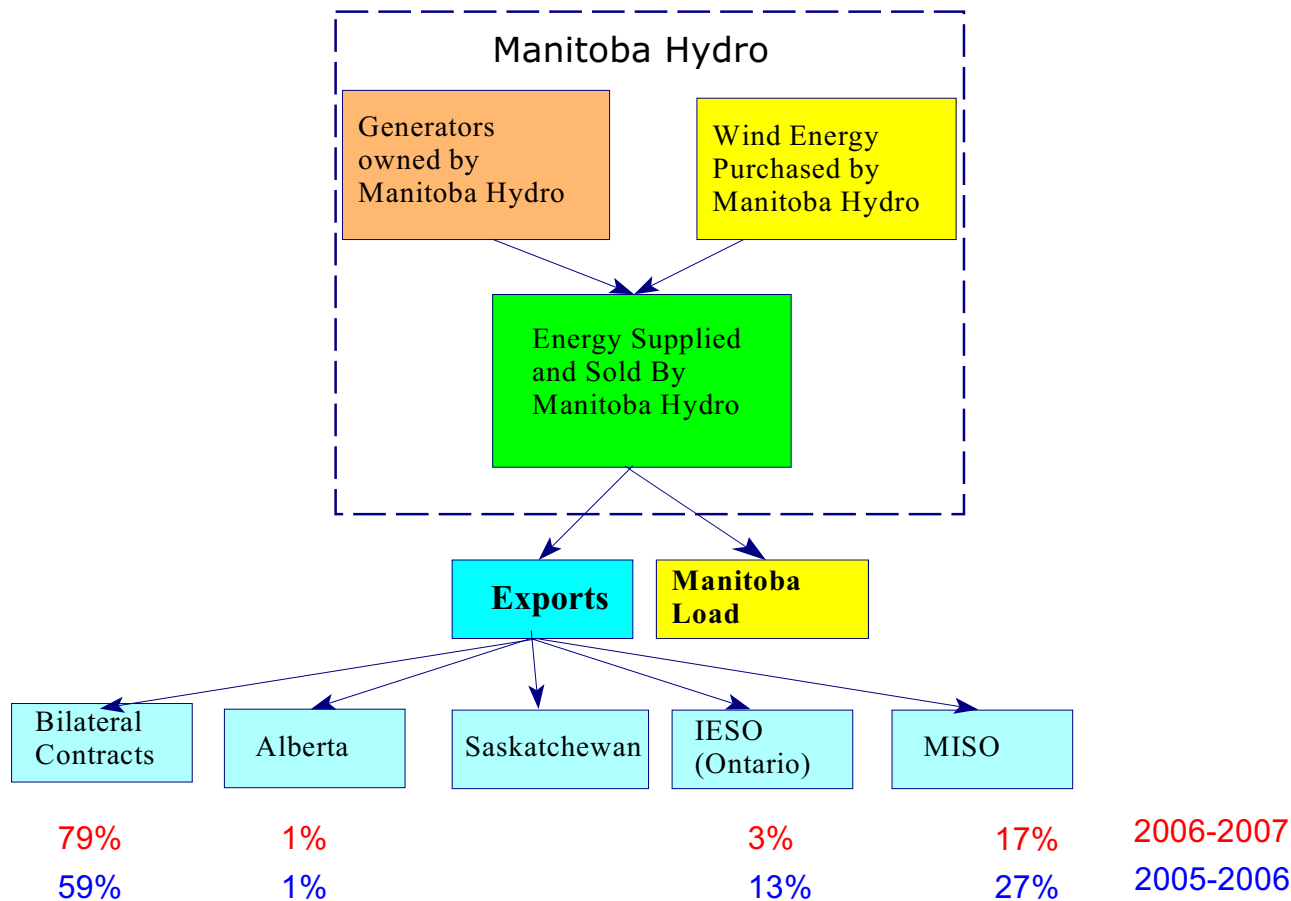
Terms of Reference

- The identification and documentation of all risks associated with the export of electricity through the Power Sales and Operations Division.
- The provision of recommendations regarding the appropriate measures to monitor, quantify and report on identified risks.
- The provision of recommendations regarding the appropriate organization and staffing of the independent Middle Office.

Modeling Core Business



Risks In Power Export



- Market Access Risk
- Credit Risk
- Foreign Exchange Risk
- Forecasting Risk
- Over-commitment Risk.

Risks in Power Exports

Type of Risk	Description	Measurement	Responsibility
Market Access Risk	Risk that access to US market may be cut off.	It's a binary event. Periodically political developments be analyzed and implications assessed.	Higher Management
Credit Risk	Risk of selling to bad credit counter parties or default by counter parties	Credit Monitoring, Credit Limits, Receivable Outstanding.	Middle office personnel in charge of credit risk monitoring.
Foreign Exchange Risk	Risk of unfavorable movement in US\$ which is the currency of trading.	Measurements are possible, but this risk is best managed in an aggregate manner for the whole organization	Treasury

Risks in Power Exports

Type of Risk	Description	Measurement	Responsibility
Forecasting Risk	Risk of erroneous forecasts or forecasting model being outdated.	Mean Squared Error, Regression Approach	Middle office personnel in charge of monitoring forecasting risks.
Over-Commitment Risk	Risk of selling power beyond the generating ability.	Monitoring of commitment vis a vis forecast	Policy on Cap by Higher Management. Monitoring by middle office.

Middle Office

Structure and Reporting Relationships

- Under the control of the Accounting and Finance Side of the Organization.
- Should have access to all documentation used by Power Trading
- Two Persons
 - ▶ One for Credit Risk and Over Commitment Risk
 - Commerce Graduate
 - ▶ One for Forecasting Risk
 - Undergraduate in Mathematics or Statistics with preferably a course in Forecasting.

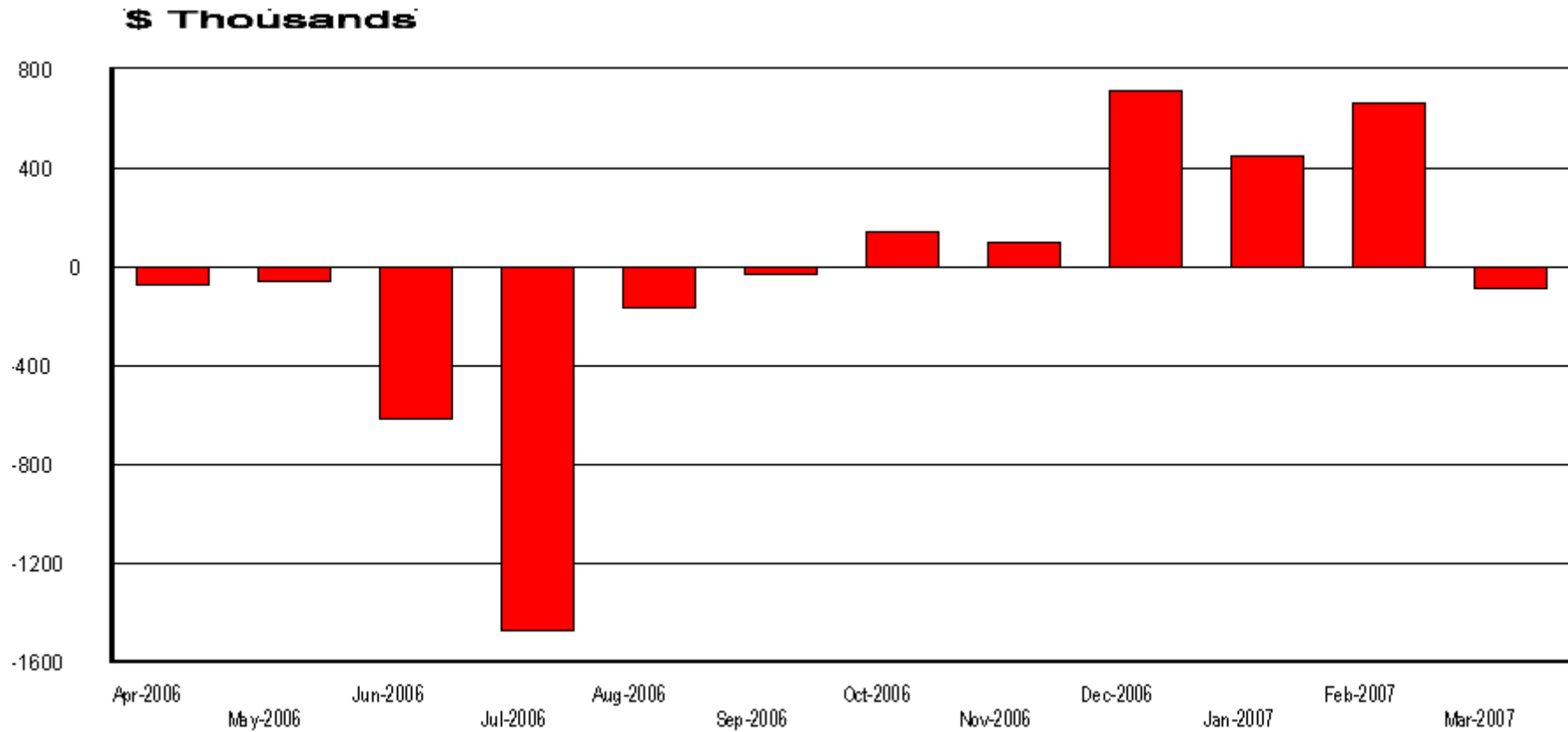
Hedging or Trading

Virtual Trading and FTRs

- Virtual Sales and Purchases are speculative transactions.
- FTRs are meant to cushion Loads against unfavorable Marginal Congestion Charges.
 - ▶ Hydro is a generator and not a load.
 - ▶ Has long term contracts transformed Hydro from a Generator to a Load.
 - More on this later.

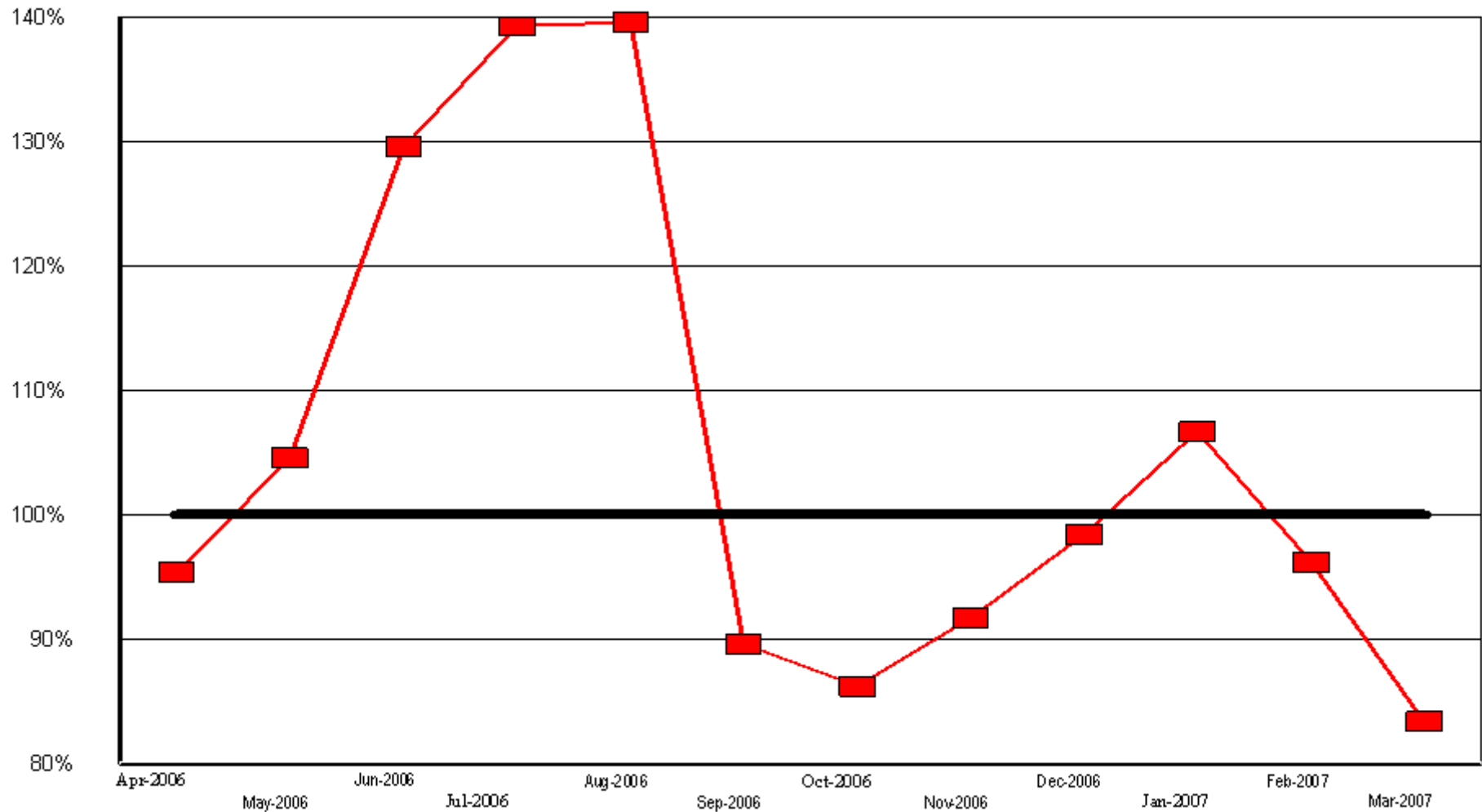
Hedging or Trading

Net Revenue from Hedging



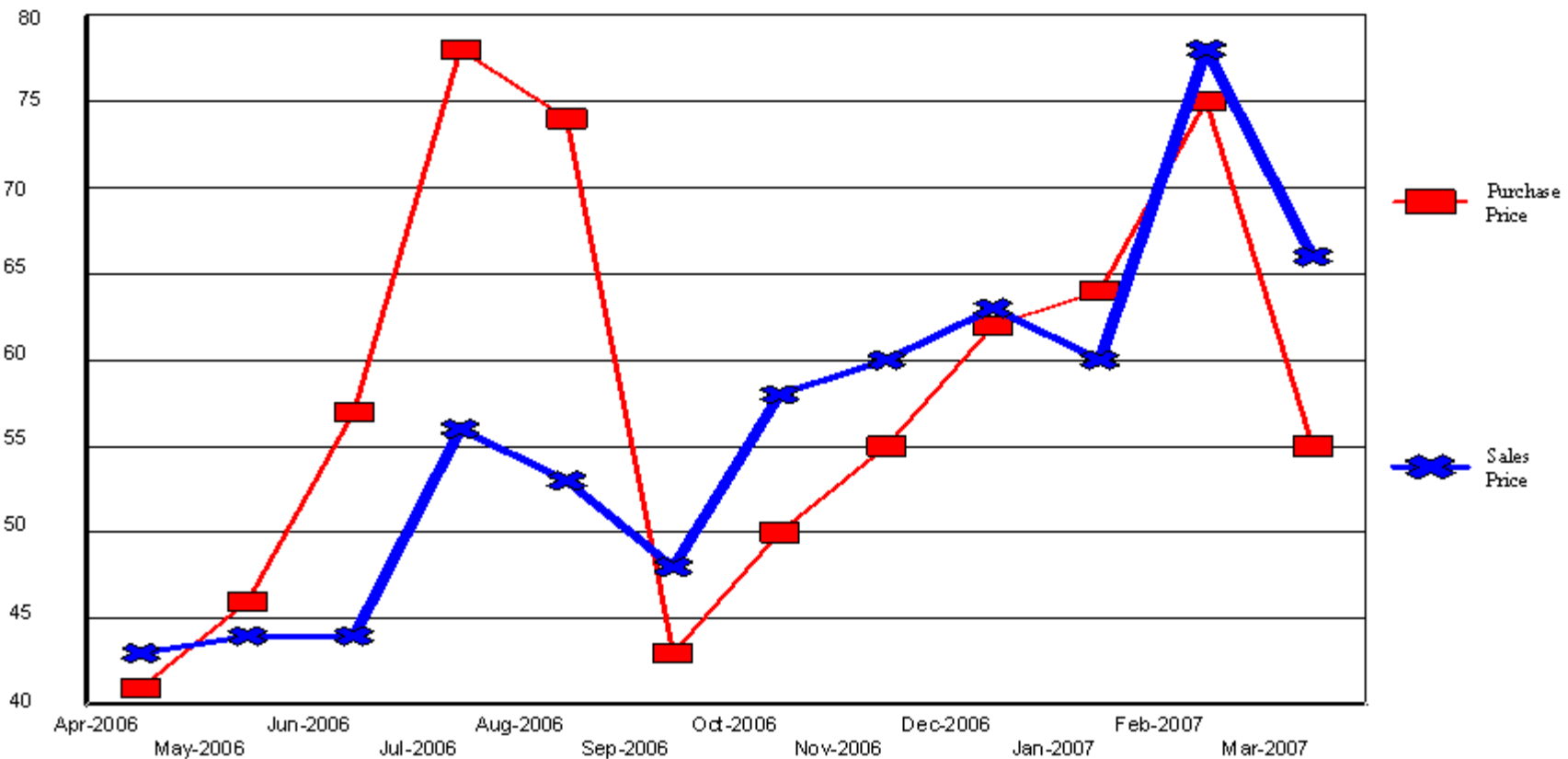
Average Prices in Trading

Average Purchase Price As Percentage Of Average Selling Price



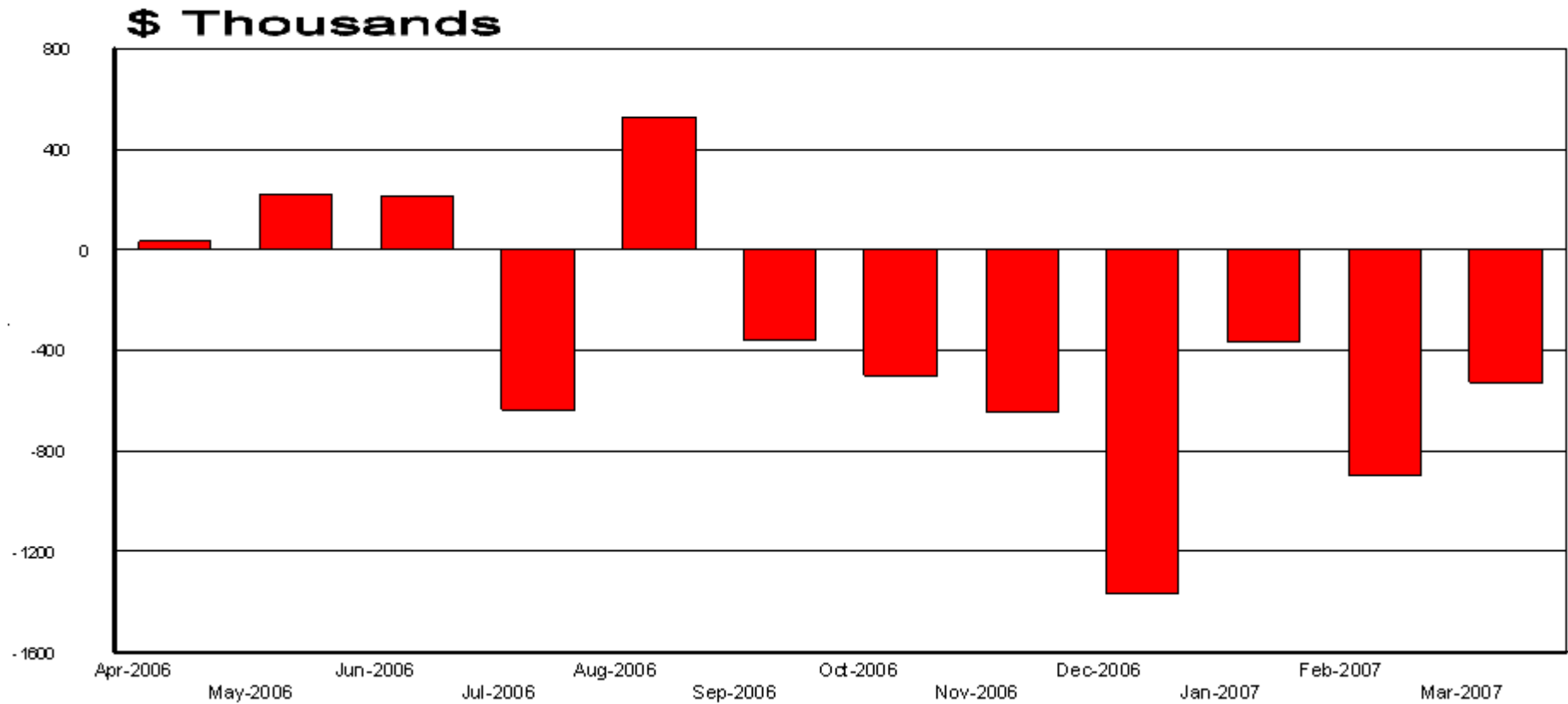
Average Prices in Trading

Average Sales and Purchase Prices in 2006-2007

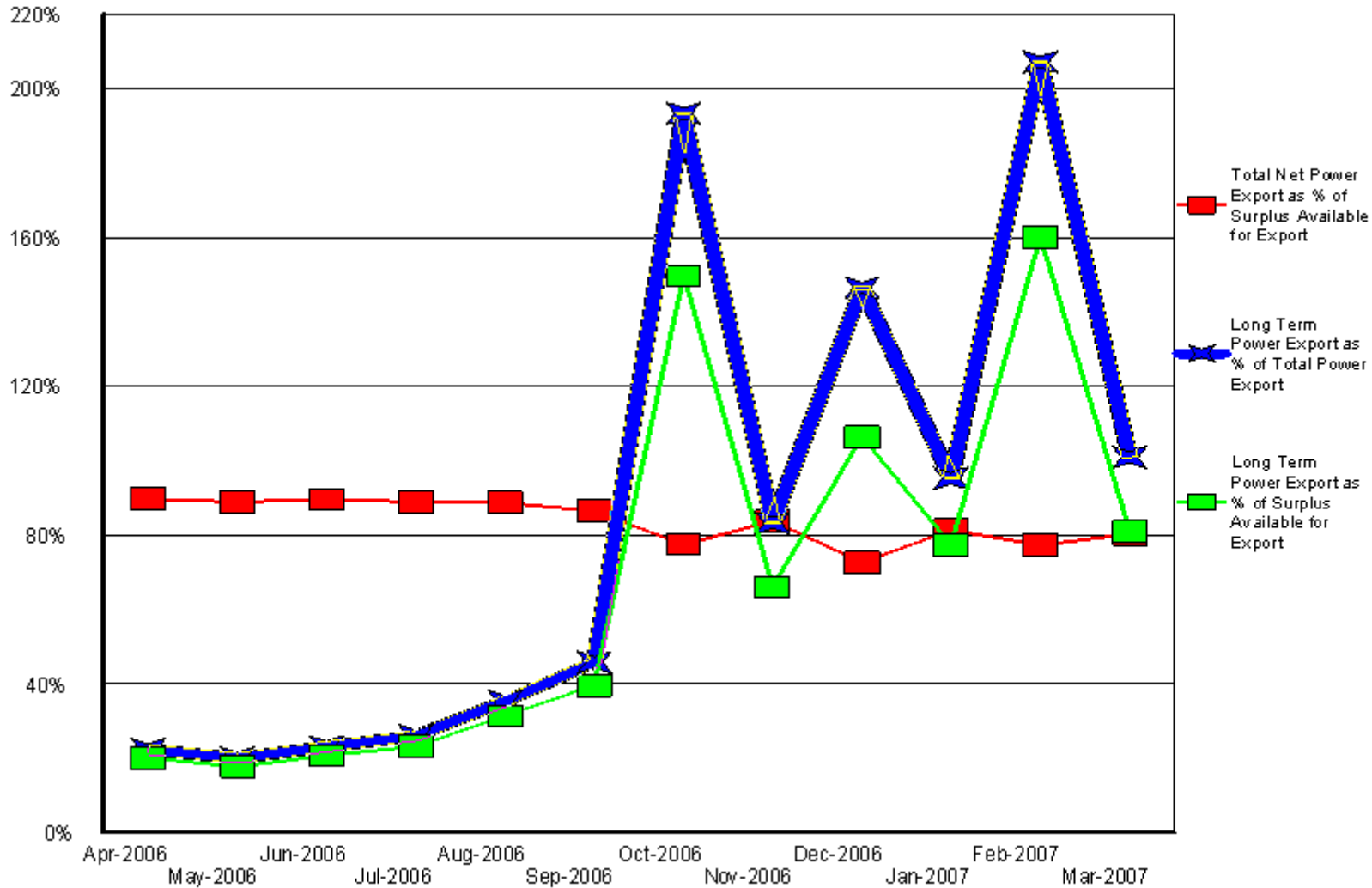


Trading to Supply Ontario

Net Revenue System Hedging Product 2006-2007



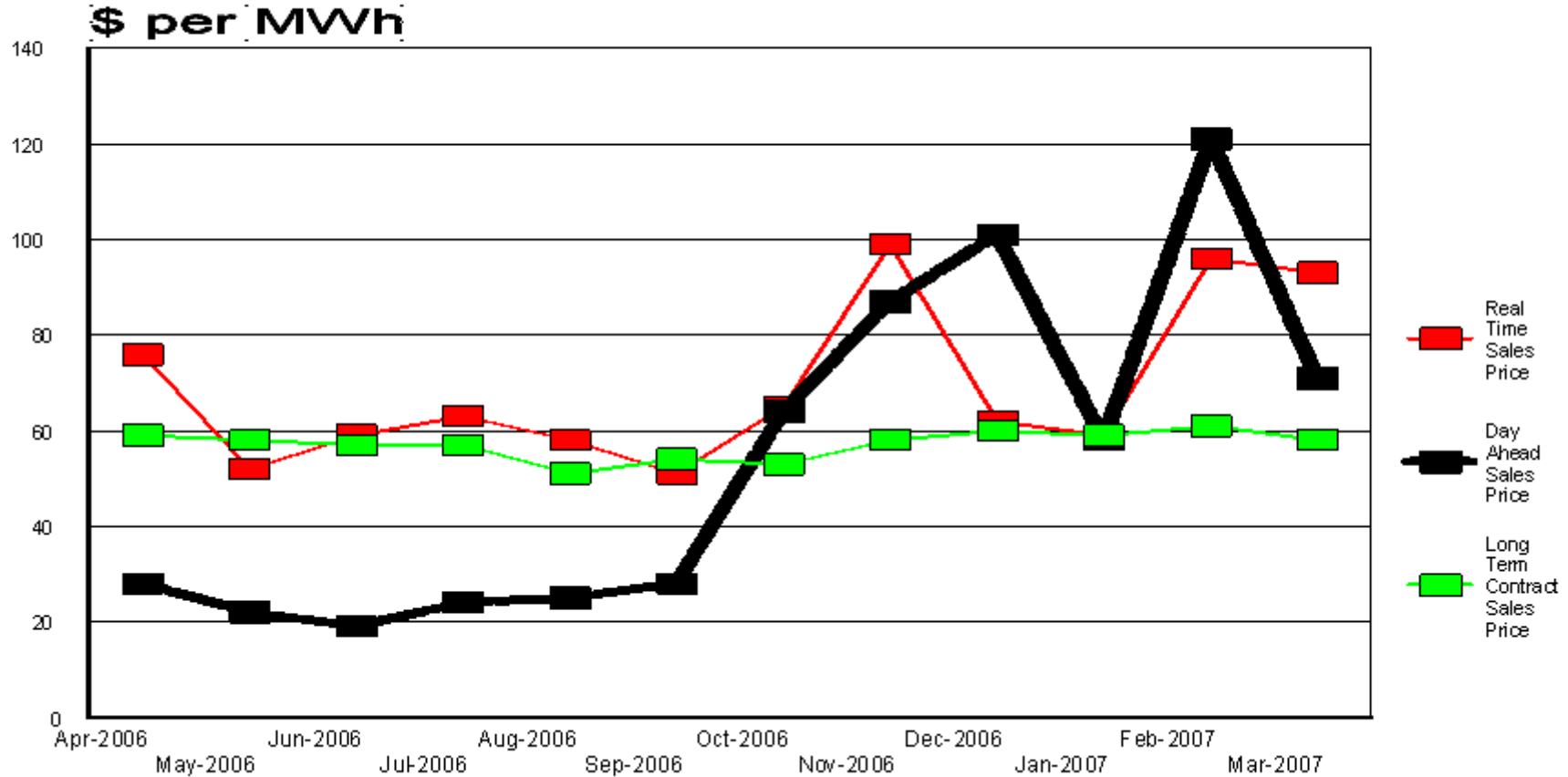
Long Term Sales



Note: November Figures are not actuals. They are average of other months

Long Term Sales

Average Prices



Other Issues

Forecasting and Optimizing

- A number of forecasting systems
 - ▶ Should be one forecasting system with audit trail.
- Day to day generation and power sales decision
 - ▶ Optimization program needed.

Summary of Recommendations

- Risks associated with energy exports are:
 - ▶ Market Access Risk
 - ▶ Credit Risk
 - ▶ Foreign Exchange Risk
 - ▶ Forecasting Risk
 - ▶ Over-commitment Risk.
- Currently Hydro is
 - ▶ Exporting Power
 - ▶ Trading in power.
 - this activity should be done by a wholly owned subsidiary. This will make for a cleaner risk management.

Summary of Recommendations

- Minimum long term commitment to sale
- Sell surplus after meeting Manitoba Demand in the Day-Ahead market.
- Use Real time market to adjust temporary shortfall/surpluses.
- Implement a companywide
 - ▶ Single Forecasting System
 - ▶ Single Companywide Optimization system for operating decisions
 - ▶ Both system should have audit trails.

Summary of Recommendations

- Middle office Under the Control of the Accounting and Finance Branch.
- Two persons Required In middle Office
 - ▶ A Commerce Graduate
 - ▶ A Graduate In Mathematics/Statistics
 - Desirable Some Course Credits in Forecasting.